Promoting
Timber Gro
Policies Toward
Non-Industrial Fores
in New Brunswick
Paul B. Hende

85-5665/

The Institute for Research on Public Policy
L'Institut de recherches politiques

A national, independent, research organization
Un organisme de recherche national et indépendant

Founded in 1972, The Institute for Research on Public Policy is a national organization whose independence and autonomy are ensured by the revenues of an endowment fund which is supported by the federal and provincial governments and by the private sector. In addition, the Institute receives grants and contracts from governments, corporations and foundations to carry out specific research projects.

The *raison d'être* of the Institute is threefold:

- To act as a catalyst within the national community by helping to facilitate informed public debate on issues of major public interest
- To stimulate participation by all segments of the national community in the process that leads to public policy making
- To find practical solutions to important public policy problems, thus aiding in the development of sound public policies.

The Institute is governed by a Board of Directors, which is the decision-making body, and a Council of Trustees, which advises the Board on matters related to the research direction of the Institute. Day-to-day administration of the Institute's policies, programs and staff is the responsibility of the president.

The Institute operates in a decentralized way, employing researchers located across Canada. This ensures that research undertaken will include contributions from all regions of the country.

Wherever possible, the Institute will try to promote public understanding of, and discussion on, issues of national importance, with clarity and impartiality. Conclusions or recommendations in the Institute's publications are solely those of the author and should not be attributed to the Board of Directors, Council of Trustees, or contributors to the Institute.

The president bears final responsibility for the decision to publish a manuscript under the Institute's imprint. In reaching this decision, he is advised on the accuracy and objectivity of a manuscript by both Institute staff and outside reviewers. Publication of a manuscript signifies that it is deemed to be a competent treatment of a subject worthy of public consideration.

Publications of the Institute are published in the language of the author, along with an executive summary in both of Canada's official languages.

PROMOTING TIMBER CROPPING:
POLICIES TOWARD NON-INDUSTRIAL FOREST OWNERS IN NEW BRUNSWICK

PROMOTING TIMBER CROPPING:
POLICIES TOWARD NON-INDUSTRIAL FOREST OWNERS IN NEW BRUNSWICK

PAUL B. HUBER

The Institute for Research on Public Policy/
L'Institut de recherches politiques

Copyright © The Institute for Research on Public Policy 1985
All rights reserved

Printed in Canada

Legal Deposit Second Quarter
Bibliotheque nationale du Quebec

The Institute for Research on Public Policy/
L'Institut de recherches politiques
2149 MacKay Street,
Montreal, Quebec H3G 2J2

Canadian Cataloguing in Publication Data

Huber, Paul B. (Paul Bickford), 1934-
Promoting timber cropping: policies toward
non-industrial forest owners in New Brunswick

Foreword in English and French.
Bibliography:p.
ISBN 0-88645-023-3

1.Forest policy--New Brunswick. 2.Wood-lots--
New Brunswick. I.Institute for Research on
Public Policy. II. Title.

SD568.N48H82 1985 333.75'09715 C85-090134-0

CONTENTS

Table of Contents v
List of Tables vii
List of Figures ix
Acknowledgements xi
Foreword xiii
Avant-propos xvii
The Author xxi

Executive Summary and Introduction xxiii
The Problem
A Summary of Results
Organization

1. The Setting for Forest Policy 1
Introduction
Forest Policy Challenges in New Brunswick
Conclusion

2. The Production of Forest Outputs 17
Introduction
Diversity
Forest Growth
Forest Management
Forest Regulation
Conclusion

3. The Markets for Woodlot Timber in New Brunswick 35
Introduction
Small Private Woodlots
Wood-Processors: The Purchasers of Timber
Marketing Boards
Marketing Woodlot Timber: Quantity, Prices and Delivery Tickets
Conclusion

4. The Crown Lands and Forests Act 61
Introduction
Primary vs. Residual Source of Supply
Stumpage Prices on Crown Land
Conclusion

5. Investing in the Management of Small Private Timberlands 79
Introduction
Woodland Management: Resource Availability and Ownership Goals
Returns to Timber Growing and Forest Management
Non-industrial Nature and Scale of Woodlots
Stumpage Prices and Decisions to Harvest and Manage
Conclusion

6. Options for Public Policy 103
Introduction
Proposals of the New Brunswick Private Woodlot Resources Study
Forest Policy and the Woodlot Problem
Envoi

Appendix to Chapter 3:
Marketing Timber from Woodlots: A Diagrammatic Analysis 125
Introduction
Perfect Competition for Buyers, Contractors and Forest Owners
Wood-Processor Monopsony Power
Monopsonistic Price Discrimination by Wood-Processors
Exercise of Monopsony Power by Contractors
Marketing Board Cartel and Perfectly Competitive Timber Buyers
Marketing Board Cartel and Monopsony: Price Bargaining Only
Marketing Cartel and Monopsony: Price and Quantity Bargaining
Effect of Changes in Demand on Stumpage Rates
Conclusion

Notes 141
References 157
The Members of the Institute 173
Institute Management 175
Publications Available 177

LIST OF TABLES

1.1 Forest Land in Canada and in Atlantic Provinces - 1976 2

1.2 Economic Importance of the Forest Industries in Canada and Selected Provinces - 1980 5

1.3 Forest Inventory, Depletion and Growth: Canada and the Atlantic Provinces 7

3.1 Forest Statistics by Ownership in New Brunswick 39

3.2 Productive Forest Area by Resource Region and Ownership 41

3.3 Woodlot Owners and Acreages in New Brunswick by Marketing Board Area 42

3.4 Wood-Processing Capabilities of Major Firms in New Brunswick - 1980 44

3.5 Marketing Board Regulations: Range of Application and Qualifications of Electors and Board Members 48

3.6 Apparent Timber Supply to Major Firms (Licensees) from Crown land and Marketing Boards 1982 - 1983 50

3.7 Contracted and Annual Allowable Cutting Volumes from Woodlots by Marketing Board Area 53

4.1 Roundwood from New Brunswick Consumed in Provincial Pulpmills and Sawmills 65

4.2 Past Crown Royalty Rates 73

4.3 New Brunswick Crown Royalty (Stumpage) Rates 74

LIST OF FIGURES

2.1 Yields 21

2.2 MAI & Maximum Biological Yield 21

2.3 Growth Rates of Volume and Value of Timber 25

2.4 Sawlog Yield with Thinning 25

3.2 Boundaries of Forest Administrative Regions, Crown Licenses and Marketing Boards in New Brunswick 52

5.5 Alternative Perceived Price Scenarios 95

A3.8 A Competitive Timber Market 128

A3.8 A Monopsonistic Timber Market 128

A3.3 A Monopsonistic Timber Market with Price Discrimination Based on Distance 133

A3.3 A Timber Market with a Marketing Board 133

ACKNOWLEDGEMENTS

The New Brunswick Department of Natural Resources and Private Woodlot Resources Study, who commissioned and financed this research through the Institute for Research on Public Policy, accorded me complete freedom. Hence, I alone am responsible for inadequacies and errors.

I am intellectually indebted to many persons who generously shared their time and thoughts; they should be credited with contributing to whatever felicitous insights the study may contain. I want particularly to recognize Pauline Roy, who provided essential administrative support; Joakim Hermelin, who tried valiantly to give me a crash course on forest management; Ernest Gould, who gave me free run of the Harvard Forest Library; Gordon Baskerville, who straightened me out on many points; Les Reed and Lloyd Irland, who constructively criticized an early version of the manuscript; Monique Henderson Comeau, who typed under considerable pressure; Urs Frei, who removed stylistic flaws; and Barry Lesser, who managed the research project.

My thanks to all, and especially to my wife for her patience, help and understanding.

Paul B. Huber

June 1985

FOREWORD

Forestry is one of Canada's most important industrial sectors. Forestry and related activities account for close to ten per cent of Canadian jobs, when all of the linkages of the forest products sector are taken into account. That sector by itself generates approximately eighteen per cent of total Canadian exports.

Canada's forest industry today is experiencing major difficulties. Perhaps the most important long term problem facing the industry is to ensure a continuing supply of timber, something which historically has been taken for granted but no longer can be. Our forests face a serious depletion problem on economically exploitable forest lands. Intensive forest management has become a necessity.

Dr. Huber's study examines the case of private woodlots (non-industrial forest holdings) in the province of New Brunswick. It analyzes the implications of current government initiatives to induce improved forest management on these lands and offers some alternative policy options to be explored.

Ninety percent of Canada's forest is Crown land. Less than 10% of the productive accessible timberland is privately owned. But the strategic importance of privately owned forest

land, as Dr. Huber points out, far exceeds what is implied by these percentages. This is especially true for the Maritime Provinces, where the proportion of private forest land is fifty percent or more of the total timberland. Even at the national level, however, in areas such as southern Ontario and Quebec, privately owned forest land is of great importance to many individual communities and, as some of the most accessible forest land, to the supply of timber overall.

The public policy implications of all of this are great. While Dr. Huber's study is specific to New Brunswick, its analysis and findings are not limited to New Brunswick. The problem it addresses -- that of managing privately held forest land -- is significant in several other provinces. The problem of forest management more generally is significant in all of Canada. As Dr. Huber notes, "Canada is reaching ... the end of the exploitative stage of forestry."

It has, of course, to be recognized that views diverge on some of the basic assumptions underlying any analysis of forest policy. The weights placed on the risks associated with extensive use of pesticides in forest management differ widely from one analyst to another, for example. More profound differences exist as to the criteria which should govern investment and harvesting decisions in a long-term strategy for forest management. These criteria may reflect a philosophy of stewardship, and hence impose a fundamental requirement that stocks be maintained intact for the benefit of future generations. Or they may reflect more conventional project evaluation principles and market solutions to the forest management problem. Policy discussions in the forest sector thus are confounded by differences in underlying assumptions, in the interpretation of existing data, and in judgments as to consequences of proposed actions to preserve or to harvest existing stocks, or to build up new stocks. What is obvious is that a new era of timber cropping must begin to displace the simple approach of exploitation of the natural forest which has

dominated to now and that public policy has an essential role to play in bringing about this change. The Institute hopes that this analysis of the problem in New Brunswick will assist both those in New Brunswick and others in the rest of Canada in plotting this new course.

Rod Dobell
President
June 1985

AVANT-PROPOS

La forêt est l'un des principaux secteurs industriels du Canada. En effet, l'exploitation forestière et les industries connexes emploient près de dix pour cent de la main-d'oeuvre canadienne, lorsqu'on tient compte de toutes les ramifications du secteur des produits forestiers. A lui seul, il représente environ dix-huit pour cent des exportations totales du Canada.

L'industrie forestière canadienne se trouve actuellement aux prises avec des difficultés considérables. A long terme, le problème le plus urgent est sans doute d'assurer le maintien de l'approvisionnement en bois, chose qu'on ne peut plus, comme on l'a toujours fait, se permettre de considérer comme acquis. En effet, la menace du déboisement pèse sur nos terres forestières économiquement exploitables. Un aménagement forestier intensif est donc devenu une nécessité.

Dans son étude, M. Huber examine le cas des terres boisées appartenant à des particuliers (les terres forestières non industrielles) dans la province du Nouveau-Brunswick. Il analyse les conséquences des efforts actuellement entrepris par le gouvernement pour favoriser une amélioration de leur gestion et propose un certain nombre d'autres options de politique méritant d'être explorées.

Quatre-vingt dix pour cent des forêts canadiennes appartiennent à la Couronne. Moins de dix pour cent des terres boisées accessibles et productives appartiennent à des particuliers. Toutefois, comme l'auteur nous le fait remarquer, l'importance stratégique des forêts privées dépasse largement ce que semblent indiquer ces chiffres, et notamment dans les provinces Maritimes, où les forêts privées représentent la moitié ou plus de la superficie totale en terres boisées. Même sur le plan national, dans les régions comme le sud de l'Ontario et le Québec, les terres forestières privées jouent un rôle important dans la vie de nombreuses communautés et, en tant que forêts les plus accessibles, représentent une large part des resscurces totales en bois de grume.

La portée de toutes ces considérations pour la politique d'État est considérable. S'il est vrai que cette étude traite du Nouveau-Brunswick, ses analyses et ses conclusions dépassent le cadre de cette province. En effet, le problème qu'elle pose -- à savoir la gestion des forêts privées -- intéresse plusieurs provinces et, plus généralement, le Canada tout entier. Comme l'auteur nous le fait remarquer, "le stade de la simple exploitation des ressources forestières ... tire à sa fin au Canada."

Il convient de noter que certaines des hypothèses de base qui sous-tendent toute analyse d'une politique forestière ont naturellement donné lieu à des divergences de vues. Par exemple, tous les analystes n'accordent pas la même importance aux risques liés à l'usage intensif des pesticides dans le cadre de l'aménagement forestier. Il existe des divergences encore plus profondes en ce qui concerne les critères devant présider aux investissements de l'État et aux décisions en matière de récoltes dans une stratégie d'aménagement forestier à long terme. Ces critères peuvent refléter un esprit d'intendance et, par conséquent, imposer une exigence fondamentale de conservation des stocks dans l'intérêt des

générations à venir. Ou bien, ils peuvent traduire des critères d'évaluation de projet plus traditionels et des solutions de marché au problème de l'aménagement forestier. Ainsi, les discussions de politique dans le secteur forestier sont faussées par des divergences au niveau des hypothèses sous-jacentes, de l'interprétation des donnéees existantes et de l'appréciation des conséquences des projets de préservation ou de récolte des stocks existants ou de constitution de nouveaux stocks.

Il est donc évident qu'il faudrait s'engager dans une ère nouvelle d'aménagement forestier pour mettre fin à la simple politique d'exploitation de la forêt naturelle qui a régné jusqu'ici, et que la politique d'État est appelée à jouer un rôle essentiel dans cette évolution. L'Institut espère que cette étude du Nouveau-Brunswick aidera tous ceux qui s'intéressent à ce problème, tant dans cette province que dans le reste du Canada, à tracer cette voie nouvelle.

Rod Dobell
Président
Juin 1985

THE AUTHOR

Four generations of Paul Huber's family were in the business of manufacturing shooks and retailing lumber. Breaking this pattern, he studied economics in the United States, West Germany and Norway, completing his doctorate at Yale University. Subsequently, he joined the faculty at Dalhousie University, where he is an Associate Professor in the Department of Economics. His research has focused on applications of micro-economic theory. Among his publications are several on regulation of telecommunications and of gasoline marketing. In addition, he authored a book which attempts to forecast future development of high-speed ground transportation in Europe on the basis of an assessment of German railway experience in the nineteenth century. He has taught, *inter alia*, elementary finance and microeconomics, and he has served for several years on Dalhousie University's Investment Committee.

EXECUTIVE SUMMARY AND INTRODUCTION

The Problem

Forest-based industry is big, export-oriented business in Canada, and particularly in New Brunswick. Jobs and incomes depend on its continued economic health. But within the next two decades the available natural supply of timber will no longer suffice in New Brunswick. In significant measure, this is the result of a serious age-structure imbalance: too many old trees and not enough middle-aged ones. The apprehended future shortage presages a transition from exploitation of inherited forest inventory to cropping of regenerated timber. This implies outlays for more intensive management of some forest lands, including small freeholds (woodlots). The latter account for a third of the Province's forest area and somewhat less of its annual timber harvest. If silviculturally treated and more intensively managed, woodlots could supply more pulpwood, produce higher quality trees, and hopefully yield more revenues. However, forest management takes money and time. Non-industrial owners of forestlands do not regard themselves as Santa Clauses; at least in part, their anticipations of the effects on their net incomes and amenity will determine the intensity of their forest management

activity.

In addition to coping with a threatened softwood shortage in the medium-term, forest policy in New Brunswick faces a number of related challenges:

- inhibiting on-going budworm infestations of fir and spruce;
- improving the quality of hardwood and softwood forest inventory;
- utilizing harvested timber fully; and
- in the long-run, expanding the forest resource.

The Province has scarcely been ignoring these issues. Indeed, the recently implemented Crown Lands and Forests Act (CLFA) is a major initiative shifting forest policy away from exploitation toward tree-cropping on industrial forest holdings of the Crown and of major forest-product firms.

Toward the non-industrial part of their forest resource, the main thrust of official New Brunswick policy has been the encouragement of timber marketing boards, primarily as a way of counterbalancing the market power of wood-processors. But to the extent this policy increases revenues of timber sellers, it also increases costs of wood-processors, who are price-takers with respect to their sales of processed outputs. This potential for reduction in the competitiveness of New Brunswick's forest-based industry, which traditionally has been a marginal supplier on export markets, constitutes a major dilemma for forest policy: the margin for increasing returns to private non-industrial forest owners may be insufficient to induce them to spend significant sums on intensive forest management.

The primary task of this monograph is to analyse the economic incentives to manage more intensively the non-industrial forest holdings -- woodlots -- in New Brunswick. Specific issues addressed are

- whether the provisions of New Brunswick's Crown Lands and Forests Act will raise the prices of woodlot timber on

delivery to wood-processing plants,

- whether higher delivered prices imply higher returns to woodlot owners,
- whether higher returns to owners will generate more intensive woodlot management, and
- whether other policy measures may be appropriate.

Some features of the non-industrial timber market in New Brunswick are unique; nevertheless, many are replicated elsewhere. Moreover, the problem of managing non-industrial forestlands is common to all provinces. Hence, some of the study's findings will have application beyond the Province.

It must be emphasized that economic inducements to woodlot owners are the primary object of analysis. This dictates an economic, not a conservationist perspective, one focused primarily on private valuations of timber, woodlands, and management inputs by non-industrial forest owners, not by professional foresters or industry. Woodlots are -- by definition -- not industrial forestlands; they are modest in size, and their owners are not necessarily oriented toward commercial timber production. An examination of the economic motivations of timberland smallholders must start from the premise that most of the owners are expected to react to economic stimuli which affect them personally.

A Summary of Results

Although mainly aimed at improving the management of Provincial Crown lands and industrial forestlands owned by Crown licensees, the Crown Lands and Forests Act did include two mechanisms which were intended to increase the industrial demand for timber cut from non-industrial holdings and thus lead to higher prices for timber deliveries from these woodlot holdings. First, the statute ostensibly established woodlots rather than Crown land as the primary source of industrial wood. Second, it increased royalty rates on Crown stumpage, thus reducing or eliminating low-price Crown competition on the

timber market.

Since available timber utilization data does not demonstrate that woodlots were the residual supply source prior to 1982, the reference to primary sourcing in the Act may have introduced no genuine change in sourcing priorities. But it did generate controversy, which the Minister of Natural Resources resolved in 1983 with a statement interpreting primary sourcing as proportional sharing of demand fluctuations relative to the full-capacity level of wood-utilization. Because this proportionality relates to an input level which cannot be sustained, somewhat disproportionate variations in guaranteed woodlot sourcing are implied in practice. This is not surprising, since another important goal of the statute is high income and orderly harvesting from Crown land. Whether this feature of the Act will much expand industrial demand for woodfibre sourced from woodlots is open to question.

The second mechanism appears more promising. Certainly, Crown timber royalty rates have significantly risen since the Act came into force in 1982. This has strengthened the negotiating position of the timber marketing boards in the Province. However, Crown timber royalties under the Act are based on private stumpage rates. Hence, further increases in royalty levels are likely to be modest. Moreover, the strong element of circular causation makes this feature of the law somewhat ambiguous.

To analyse the link between delivered prices paid by wood-processing firms and the returns received by the private owners of the timber harvested, one must distinguish the separate activities of timber-growing, timber-harvesting, timber-hauling, and timber-processing; and then examine the roles of processing firms, logging and hauling contractors, non-industrial forest owners, and timber marketing boards. Firms producing forest products in New Brunswick sell their processed outputs on world markets over which they have little control. But the market for the timber they purchase is

imperfect in several respects:

- Collectively, the seven (shortly to be six) major wood-processing firms utilize nine-tenths of the timber cut in the Province. To varying degrees, all are vertically integrated, obtaining on average only about a quarter of their timber supply from non-industrial sources.
- Geographical isolation from one another enables these firms to exercise market power when buying timber from woodlots, and to price-discriminate with respect to delivery distance;
- Marketing boards are a countervailing influence, possessing "sellers' power". However, the regulations governing some boards encourage control by contractors; to some degree, these boards appear to act in the interest of loggers rather than owners.
- Accurate information regarding private stumpage rates is hard to come by; hence owners who sell stumpage have trouble finding out what it is worth, and are in a disadvantageous position in negotiating with loggers.

This market structure involves processor oligopsony, together with an element of bilateralism which little protects non-industrial timber producers, but does shield contractors against the market power of the dominant firms by disjoining delivered prices from stumpage rates. Prices on delivery may rise without influencing average stumpage rates; indeed a number of industry participants suggested that this had in fact occurred in recent years.

A long-term increase in the demand by industry for woodfibre from woodlots will generally result in higher quantities delivered and higher prices negotiated between marketing boards and processing companies. This is immediately apparent to contractors, who will intensify efforts to pursuade woodlot owners to harvest. Were competition among contractors vigourous and the value of timber on woodlots stable or rising,

stumpage prices would almost certainly rise, too, as larger volumes of stumpage were sold, although not necessarily by the same dollar or percentage amount. However, neither condition is met. Because of budworm-damage, much woodlot timber is deteriorating in value; hence woodlot owners have been more eager to harvest. Logging and hauling costs may on average be higher for the additional timber delivered and marketing boards (and major firms) control deliveries and restrict competition among contractors through the distribution of delivery "tickets." This reinforces the imperfections of the timber market. In these circumstances, higher delivered prices for woodfibre will likely cause little increase in average stumpage rates, even in the absence of a salvage problem.

Suppose that doubts regarding the effectiveness of current Provincial policy (as embodied in marketing board legislation and the CLFA) in increasing stumpage returns to woodlot owners could be put aside. Would these owners regard the higher level of returns as permanent? Would the higher stumpage rates lead them to manage their forest properties more intensively; that is, to apply more labour, equipment, know-how and supervision to try to expand their forest outputs in the future?

Whether an inflation-adjusted change in stumpage rates is perceived as permanent or transitory has important consequences for decisions to harvest and to engage in forest management. If deemed permanent, this enhances the profitability of management, but only slightly increases the incentive to harvest immediately. Conversely, if harvests increase noticeably -- which is generally thought to be the case -- this implies that woodlot owners regard the price change as transitory, hence warranting no change in their management activity. A sellers' market for pulpwood from 2000 to 2020 is expected to succeed the present glut. However, it is too late for woodlot management efforts to increase potential harvests by much during this favourable selling period. According to informed estimates, maximum silvicultural input could raise the

sustainable harvest from woodlots in New Brunswick by only 18 percent. Although management options for increasing timber supply after 2020 become increasingly unrestricted, that supply will likely encounter a buyers' market, on which stumpage prices will be reduced. Uncertainty regarding stumpage prices and woodlot output levels likely to prevail when current forest investments mature implies that existing stumpage price levels provide a tenuous basis for long-term forest management decisions.

For woodlot owners to introduce or increase forest management is an investment decision, dependant on the availability of inputs and on the anticipated rate of return relative to alternatives. Most woodlot owners are not opposed in principle to harvesting, but few regard timber production as their primary ownership goal. This is not inconsistent with wanting a favourable price when selling timber, but it does mean limited knowledge about and interest in managing forest land to produce timber outputs. Reluctance to enter into commitments extending over a forty to sixty year crop cycle, and lack of time, skills, and money also limit the extent of forest management practiced by non-industrial forest owners.

What rates of return do forest management activities yield? The apparent divergence in opinion on this question is remarkable, reflecting not only confusion regarding the treatment of inflation, but *inter alia*, geographical and species differences and corresponding variations in prices of products, inputs, and land. However, a careful appraisal of rates of return to forest management for softwood pulpwood production in New Brunswick, on an inflation-adjusted basis, indicates a four percent per annum yield under the most favourable conditions. As alternatives, essentially risk-free term deposits have averaged 3%, and common stocks about 6% real return over long periods; hence financial returns cannot generally justify illiquid and risky investments in forest management. Not its own yield, but profits on associated

processing activities lead integrated industrial forest companies to carry out silviculture. The costs of such operations on industrial holdings are not so adversely affected by small scale as those of woodlots, which are also totally dependent on external markets for sales of stumpage, as well as taxed unfavourably.

In New Brunswick, the spruce budworm poses a special difficulty because it continues to damage timber on woodlots more than on industrial holdings. This arises from the proximity of much of the non-industrial forest to dwellings, and hence its exclusion from protection by spraying. In addition, woodlot owners collectively are less able to deal with the infestation and the resulting salvage problem than other owners, primarily because they have no mechanism for reaching joint decisions on harvesting. In the short run, this plague causes downward pressure on stumpage rates; in the long run, it creates monumental uncertainty with respect to investment returns on forest management activities on smallholdings. Why manage woodlots so that the budworm can have a bigger breakfast?

The presumed causal chain under examination contains five links, running from legislation regarding Crown forests and marketing boards to increased demand for timber from woodlots to higher delivered prices and then higher stumpage rates. It continues to higher profits for woodlot owners and thence to higher management intensity. No link is unflawed. Thus, it is unlikely that existing forest policies, by themselves, will induce significantly more intensive woodlot management in New Brunswick.

Would alternative policies, focusing directly on private forest management rather than relying on indirect and uncertain causation, be more likely to succeed? The recent Report of the New Brunswick Private Woodlot Resources Study made more than a dozen recommendations and nearly forty "suggestions" for improving woodlot management in the Province. Several of its

proposals are directed toward beefing-up the Province's forest product marketing boards by adding to their responsibilities, notably with respect to delivery of extension and cost-shared silvicultural programmes. The Report also suggests that governments focus their policies more precisely on non-industrial forest holdings as a distinct entity. Specifically, a redirection and restructuring of financial and tax incentives are called for. Furthermore, the Report proposes reorienting industry buying practices toward the purchase of more budworm-damaged wood and the utilization of a broader variety of species.

It is difficult to disagree with the overall tenor of these proposals. But, if implemented, will they solve the problem at reasonable cost? For example, delivering rather expensive cost-shared programmes through marketing boards will ensure a high degree of local control, and possibly reduce duplication of effort. However, few acres are treated relative to the total woodlot resource. Moreover, there is the problem of retaining treated acreage under management until maturity, a difficulty which the Report does not address. Despite emphasis on planned harvesting, marketing, and renewal of non-industrial forests under the aegis of regional marketing boards, the Report is essentially conservative: unsympathetic toward interventions which might limit the freedom of woodlot owners to mismanage their woodlands and might reduce the dominance of contractors over marketing boards. Politically, this doubtless is astute; but, lacking both teeth and financial muscle, the Report's proposals seem unlikely to achieve the desired impact on future woodlot-sourced timber supplies.

The nub of the so-called "woodlot problem" is a fundamental divergence in aims between governments on the one hand and non-industrial forest owners on the other. The public justification for expanding timber supply from woodlots is the benefit which will accrue to the wood-processing firms and their employees as a result of improved quality and increased

supply, and hence lower stumpage prices than otherwise would have prevailed. Owners, in contrast, want protection of the amenity from their woodlands, flexibility with respect to converting the value of their land and timber into cash, and an adequate and rapid payback from investment outlays. This review of existing and proposed policy measures in New Brunswick strongly suggests that considerable legislative, administrative, and financial efforts will only partially reconcile these conflicting goals, and hence will yield modest results. This has been the experience elsewhere:

> "increasing the [non-industrial forest] outputs above those that will occur naturally is very difficult, and efforts in this direction may produce but limited results not worth the public cost....
>
> (Glascock 1981, p. 6)

Are special measures to induce more intensive woodlot management in New Brunswick desirable? Ultimately, the proof of the forest policy pudding is in the net income generated through harvesting and processing timber (and the income and amenities derived from other uses of the forest) in the course of the next two generations and beyond. The real goal is better lives for New Brunswickers, not more trees. Forest management activities and their associated benefits are not free; they use up resources and inputs which could be used for other purposes. Therefore, alternative investment possibilities in forestry and other industries must be considered. They might yield a better balance of benefits and costs than increases in woodlot management, and do more to distribute income fairly in rural areas.

Organization

The study comprises six chapters and an appendix. In the first chapter, the contemporary setting for forestry policy is presented. The introduction relates the New Brunswick

situation to the national forestry context, discussing in turn the forest resource, the forest economy, the balance between harvesting and forest growth, and the transition from exploiting to cropping the timber resource. Several rationales for public concern and intervention in the marketing of timber are advanced. The rest of the chapter sketches the timber supply situation in New Brunswick and the challenges this poses for forest policy, particularly with respect to non-industrial holdings.

Chapter 2 attempts to outline the elements of forestry economics by relating the characteristics of timber production to forest growth, management, and regulation. Forest management is defined as the application of labour, capital, and entrepreneurial inputs to modify natural forest growth, and various management activities are described and classified. Since this chapter is intended for non-foresters, forestry professionals will find much of it an unnecessary digression; they can proceed directly to Chapter 3 without missing any essential steps in the argument.

Chapter 3 examines the marketing of timber in New Brunswick. The analysis addresses one of the specific issues to be dealt with in the study: the linkage between delivered prices paid for timber by wood-using firms and the returns received by the private owners of the trees harvested. The chapter includes an analysis of the oligopsonistic market structure and of the marketing environment created by marketing boards. An attempt is made to sketch the differences among regions in the Province. The appendix to this chapter develops a formal diagrammatic analysis of the timber market.

Chapter 4 concerns itself with New Brunswick's recently implemented Crown Lands and Forests Act, the most significant governmental initiative to adjust forest policy to a cropping rather than an exploitative mode. Although aimed at the management of public lands, this Act was anticipated to provide an indirect stimulus to forest management on non-industrial

woodlands by raising the demand for woodlot-sourced timber. The two principal sections of the chapter analyse the mechanisms thought to be involved: a provision for sourcing timber for industrial use "primarily" from woodlots, and higher Crown timber royalty rates. Taken together, Chapters 3 and 4 investigate the determinants of woodlot stumpage rates in the New Brunswick forest policy setting.

In Chapter 5, after outlining some broad issues regarding the management of private non-industrial woodlands, the discussion centres on the relationship between stumpage rates and management intensity: whether higher current stumpage rates will lead woodlot owners to invest more in managing their forest properties to produce larger amounts of timber for future delivery. Treating management as an investment activity directed toward the expansion of future outputs, resource and profitability constraints are examined and found likely to limit the sensitivity of management intensity to changes in stumpage prices. The chapter's final section explores the influence of an inflation-adjusted increase in stumpage prices on the decisions to harvest and to engage in forest management.

Chapter 6 advances some general propositions regarding the appropriate structure of policies to stimulate management of woodlots, and then reviews the proposals of the Report of the New Brunswick Private Woodlot Resources Study. Questions are raised whether the challenges facing New Brunswick's forest industry might not be met more cost-effectively by policy initiatives with a different thrust; and indeed, whether the benefits to New Brunswick of a limited increase in future timber supplies from woodlots will be commensurate with the costs to the Province of achieving it.

CHAPTER 1

THE SETTING FOR FOREST POLICY

Introduction

- The Resource and its Owners -

Canadians do not fully appreciate the extent of their forests and the importance of the forest industry. Bearing in mind the inevitable imprecision of such statistics, three-eighths of Canada's nearly 10 million square kilometres, are forested, and slightly over a third classified as "productive" forest land (Statscan 1982: 25-202). Although only half of this is regarded as economically accessible, one-sixth of Canada is still an enormous area. (See Table 1.1.) In Atlantic Canada, the relative significance of forests is considerably greater than in Canada as a whole; with economically accessible forests covering five-sixths of its territory, New Brunswick is by far the most heavily forested province in the country. It has 3.8% of the economically accessible forestland, yet only 1% of the total area. Softwoods make up three-quarters of the forest volume nationally; in eastern Canada, spruce and fir-balsam predominate. In the 1976-77 national forest inventory, these two species accounted for 76% of the volume of merchantable wood on New Brunswick's Crown lands and 55% of the volumes on private lands in the Province.[1,2]

TABLE 1.1

FOREST LAND IN CANADA AND IN ATLANTIC PROVINCES - 1976

(thousands of square kilometres)

	Canada	New Brunswick	Nova Scotia	Newfoundland	PEI
Total Area	9,976	73	55	405	6
Forestland	3,417	66	41	338	3
Productive and Inventoried	1,984	61	38	85	2
Economically Accessible	1,611	61	38	49	2
Provincial Crown	1,424	27	9	44	-
Federal Crown	35	-	-	-	-
Private	151	34	29	5	2

Source: Statscan 1982 (25-202). Canadian Forestry Statistics 1980, Tables 1-5.

Less than 10% of Canada's productive accessible timberland is privately owned. Concentrated in the populated parts of Eastern Canada, these holdings are more accessible to harvesting and management activities than Crown land; soil and climate are also more favourable. In New Brunswick, they account for one-half the forestland. In the Maritimes and in the southern parts of Quebec and Ontario, non-industrial forests (woodlots) comprise most of the private holdings. The proportion in New Brunswick is approximately two-thirds (one-third of the forested area). Canada-wide, private lands are believed to provide a quarter to a third of the timber harvest used by industry (Place 1978, p. 560; Ontario, MNR 1982, p. 38; Belzile 1982, p. 17). In New Brunswick, this proportion is provided by non-industrial private holdings alone. Most of the fuelwood used in homes, as well as Christmas trees, maple products, and a variety of other non-industrial outputs also come primarily from private woodlands. One-sixth of the privately-owned forests are on census farms; these yielded in imputed value of products consumed on the farm about 55% over and above the cash forestry income (Ontario, MNR 1982, p. 74).

Place states that there are from 200,000 to 300,000 owners of private forest land in Canada (1978, p. 560). However, Quebec has 125,000 (Belzile 1982); Ontario 200,000, with a minimum holding of 50 acres (Ontario MNR 1982); New Brunswick 32,000 to 40,000 (Roy 1983, Appendix III); and Nova Scotia 31,000 (Macquarrie 1981); for a total of 400,000 in these provinces alone. This degree of imprecision illustrates our lack of accurate statistics on privately-owned forests and their owners. Some of these owners are major industrial wood-users such as pulp mills; some minor manufacturers, such as sawmills; some farmers; and some fall into none of these categories. Many owners own more than one plot, possibly under different names. Land registration records provide only a general picture. There have been a number of attempts to

survey owners of small timber holdings in Canada and the United States, but most experienced difficulty in securing fully representative samples.

- The Forest Economy -

The harvesting of nearly 160 million cubic metres of timber in 1980 directly generated over $2 billion of value-added, $1.2 billion in wages and salaries, and 56,000 jobs in Canada (Statscan 1982: 25-202, Tables 13, 35 and 47). These figures refer only to logging. Contrary to popular misconception, most persons engaged in the forest industries are not hewers of wood; logging accounts for only one-fifth to one-sixth of output and employment of the forest products industries, nationwide. Wood industries (i.e., sawmills, shingle, veneer, plywood, sash and milling plants and box factories) and paper and allied industries (mainly pulp and paper mills) are both considerably more important. As Table 1.2 shows, about 5% of the value-added in Canada comes from these industries, but they are more capital-intensive than the economy as a whole. Hence, they provide only 3.5% of the jobs and 3.7% of the wages and salaries. Input-output analyses indicate that backward and forward linkages of the forest products sector are relatively strong, so that when indirect effects are taken into account, nearly ten percent of Canadian jobs and payrolls are responsive to the forest sector (Environment Canada 1981, p. 2).

Forest product shipments nationwide amounted to $23 billion in 1980. Exports accounted for more than half of this amount and for about one-sixth of all Canadian exports. Indeed, the forest products industry is the single most important contributor to the trade balance. Canada is the world's largest exporter of forest products, but traditionally has been the world's marginal supplier (Peat Marwick & Partners 1977). This applies particularly to Eastern Canada's paper and pulp producers, who are extremely dependent on export markets which they do not dominate (Irland 1982a, p. 4). Paper and

TABLE 1.2

ECONOMIC IMPORTANCE OF THE FOREST INDUSTRIES IN CANADA AND SELECTED PROVINCES - 1980

(values in billion dollars, employment in thousand persons)

	Canada	New Brunswick		Nova Scotia	
		Totals	% of Canada	Totals	% of Canada
Logging					
Value Added $	2.05	.113	5.5%	.025	1.2%
Wages & Salaries $	1.18	.066	5.6%	.015	1.3%
Employment[2]	56	4.323	7.7%	1.230	2.2%
Wood Industries[1]					
Value Added $	3.47	.095	2.7%	.045	1.3%
Wages & Salaries $	2.22	.060	2.7%	.024	1.1%
Employment[2]	110	4.304	3.6%	2.045	1.7%
Paper & Allied Industries[1]					
Value Added $	6.77	.365	5.4%	.221	3.3%
Wages & Salaries $	2.78	.137	4.9%	.065	2.3%
Employment[2]	130	6.016	4.6%	3.163	2.4%
Forest Products Total					
Value Added $	12.29	.573	4.7%	.291	2.4%
Wages & Salaries $	6.18	.263	4.2%	.104	1.7%
Employment[2]	305	14.643	4.8%	6.438	2.1%
Forest Products/ All Economic Sectors					
Value Added $	4.7%	11.0%		4.6%	
Wages & Salaries $	3.7%	8.2%		2.5%	
Employment[2]	2.9%	5.7%		2.0%	

1) For definitions, see first source.

2) Employment figures include working owners.

Sources: Statscan 1982 (25-202). Canadian Forestry Statistics 1980. Tables 13, 35 & 47.
Statscan 1982 (13-213). Provincial Economic Accounts: Experimental Data 1965-1980. pp. 9, 11.
Statscan 1982. Canadian Statistical Review, December 1982. pp.18,44.

pulp production in the Maritimes is relatively more significant than in Canada as a whole, reflecting smaller tree sizes (and hence a lower proportion of good sawlogs) and a favourable species composition (spruce and fir) for making quality papers. New Brunswick's wood processors, who comprise 4.5% of the Canadian forest industry, depend on export markets for over two-thirds of sales. This dependence means that they cannot control the prices of their wood products. As marginal sellers, they are "price-takers", and must accept relatively large fluctuations in sales and shipments. On the other hand, the 60 percent volumetric expansion of timber output over the last two decades has only been possible because of the export orientation of the Canadian and New Brunswick forest industries.

- The Forest Inventory Balance -

Canada's vast tracts of economically accessible forest contain 15 to 20 billion cubic metres of merchantable wood, nine-tenths of which is on Crown land (Statscan 1982: 25-202). 130 to 160 million cubic metres are harvested annually, and a further 10 to 25 million cubic metres is lost to forest fire.[3] (See Table 1.3.) Thus the annual gross depletion of Canada's accessible forest resource is approximately 1%. Potential growth of that resource is 300 to 400 million cubic metres per year with harvesting timed to maximize biological growth, but with no other human intervention to manage growth.[4] This implies a gross potential growth per hectare of 1.7 to 2.5 cubic metres per year -- in percentage terms, a rate of 1.5% to 2.5% -- well in excess of depletion in Canada and in New Brunswick. But harvesting has not been timed to maximize biological growth: excluding British Columbia, 40% of the Canadian hardwood forest and half its softwood forest is mature or overmature. In New Brunswick, the degree of maturity is even greater. In 1976, four-fifths of the softwood and hardwood forest resources on both Crown and private land in the Province were classified as mature or older (Statscan 1982:

TABLE 1.3

FOREST INVENTORY, DEPLETION AND GROWTH
CANADA AND THE ATLANTIC PROVINCES
(merchantable cubic metres X 10^6)

	Canada	New Brunswick	Nova Scotia	New-foundland	PEI
Forest Inventory[1]	17,229	667.00	216.00	398.00	-
Harvest 1980[1]	156	8.39	4.54	2.80	.28
% of Inventory	0.9%	1.3%	2.1%	0.9%	-
Annual Fire Loss[2]	11	.02	.04	.30	-
Annual Gross Depletion	167	8.41	4.58	3.10	.28
Mean Annual Increment[3] (Potential)	300-400	11.70	7.10	4.5-6.00	.40

Sources: (1) Statscan 1982 (25-202). Inventory values relate to 1976-7.
(2) Bowen 1978. Table A32.
(3) Bickerstaff, Wallace and Evert 1981. Table 38.
MAI is the average annual increase which would accrue over an optimal biological rotation on accessible unmanaged lands (operability classes 1 and 2; no deduction for availability)

Note: Depletion includes no provision for catastrophic losses to insects or disease.

25-202).[5] Thus, the potential national timber "growth reserve" hides a serious age-structure imbalance.

Moreover, such a global comparison may conceal local shortages of particular species or qualities of trees. It also treats costs of access and utilization rather arbitrarily. Not all trees are created equal; much of the potential and actual growth may be in species, areas or qualities which are economically unsuited for harvest. Table 1.3 indicates that the margin between potential maximum growth and gross depletion is narrower in the Maritimes than in Canada as a whole, and the percentage of inventory being cut, higher. Reed & Associates' (1978) major study of forest management in Canada found that the accessible hardwood and softwood annual harvest reserve for Canada totalled only 56 million cubic metres (assuming no change in levels of forest management or utilization).[6] Reed concluded (p. 29) that "many forest-based communities are in trouble today because their mills cannot secure an economic wood supply." For New Brunswick, Reed's study (p. 26) noted that "the existing industry has the theoretical annual capacity to utilize about 2.5 million cubic metres more roundwood and by-product wood chips than can be produced on a sustained yield basis at the existing level of forest management."

- The Transition to Timber Cropping -

Canada is gradually reaching -- and the Maritimes have reached -- the end of the exploitative stage of forestry. Up to now, the vastness of

> the forest resource and the high volume of accumulated growth in predominantly mature and overmature forests provided such a huge reserve of available forest capital in relation to the amounts being harvested, that management aimed at growth ... had no priority. Why grow more wood when there is an evident surplus ... which is deteriorating?
>
> (Bickerstaff, Wallace and Evert 1981, p. 3)

> Rather than spend money on timber management, industry has augmented its wood supplies by closer utilization, by more efficient logging and processing, and by harvesting more and more remote forests. Gains from these approaches are still possible ... but they are becoming more difficult.... [This] has been dictated by economic circumstances and has been the history of all countries finding themselves with a large capital of mature and overmature timber.... [This] capital helped pay for Canada's infrastructure.
>
> (Place 1978, p. 560)

Now the country is being forced by a close supply-demand balance to shift from exploiting inherited forest inventory to cropping regenerated growth. This process has several corollaries:

1. The age structure of the forest will become more balanced, rather than containing an excess of mature and overmature stands.
2. Gradually rising real prices accompanied the liquidation of old timber inventory in North America, but the transition to regenerated stands is likely to eliminate the upward trend of prices in real terms (Sedjo 1982).
3. Regenerated second-growth forests will not contain trees of the quality (size) found in the primeval forests (Bickerstaff, Wallace and Evert 1971, p. 7), but the gradual decline in quality experienced during the exploitation phase will end. Utilization standards may continue to be modified, of course, as technology advances, but there will be less pressure for such modification.
4. The remoteness of stands, cold climate, uneven topography and small tree size (and attendant high harvesting costs) which cause Eastern Canada to be a marginal supplier will continue and competitive pressures from more favoured

areas will likely intensify.

5. The transition from the extensive margin of cultivation to the intensive margin -- increasing capital and labour, rather than land -- implies more intensive forest management, and potentially as much as a doubling of timber output. Which holdings will be managed and who will pay for this remain unanswered questions.

There are serious implications for forest policy. On the one hand, the Crown owns extensive forest tracts on which the intensity of management inputs must be determined in light of a number of constraints, not the least of which is cost. On the other hand, any government will be concerned with ensuring that the entire forest resource -- including privately-owned holdings -- will continue to make a major contribution to the general well-being. One aspect of this concern centres on forest outputs such as water and wildlife management and recreation. Another focuses on the stability and prosperity of forest-based communities: jobs and incomes in the wood-processing sector are at risk if raw material supply becomes insufficient or too costly.

Hence, as Canada makes the transition from exploitative forestry to tree-cropping, owners of small forest holdings will be asked to do their part to help maintain a large and vital wood-processing sector: to grow more timber by raising the intensity of forest management on their holdings. The scope for this may be substantial, since it is widely believed that both large and small private timberlands "are not producing at anything like their potential and that management is poor to non-existent" (MacArthur 1979, p. 205. See also Reed & Associates 1978, I, p. 63; Ontario, MNR 1982, p. 78; and Place 1978). Yet others suggest that such moralizing is misdirected: woodlot owners do not view themselves as suppliers of cheap logs to industry (Field, 1977 and 1982c). Raup (1978, p. 122), for example, writes:

> The thrust of much current forest policy is to deny that [woodlot owners'] goals are appropriate and to insist that their primary interest in holding forestland should be the production of wood.

The response of woodlot owners will depend on the resources available to them, and on the degree to which the rewards offered (and penalties threatened) match their goals (Field 1977). Policy intervention to restructure the rewards which market forces would provide to woodlot owners has several justifications (c.f., Raup 1978; Skok and Gregersen 1975; and Page 1977):

1. private decisions regarding privately-owned timberlands may affect water supplies and amenities (recreational value, wildlife, scenic beauty) enjoyed by others;
2. private investment in forest management may be less than socially desirable because capital is tied up for long periods;
3. publicly-supported research and extension may partially compensate for information gaps and diseconomies of scale affecting many non-industrial forest owners;
4. markets for forest outputs as well as for inputs into forest management may not function well; for example, woodlot owners may need protection against the market power of wood-processors; and
5. woodlot owners as a class may deserve assistance because of possibly lower or less stable incomes or employment than average.

Forest Policy Challenges in New Brunswick

The New Brunswick forest has been logged since Colonial times (N.B. 1974, pp. 58-67 *et passim*). Until recent years, however, natural growth far exceeded the harvest. Despite this, logging did reduce the forest's quality: large trees gradually disappeared. Consequently, the proportion of softwood and hardwood sawlogs has steadily fallen. And

repeated high-grading in some areas has led to a degradation of the resource in terms of species mixture, genetic quality, and land cover (Baskerville, quoted in Lees 1978, p. 8, and Baskerville 1977, p. 29). This development is not unique to New Brunswick. As the proportion of large trees in North America's forests has gradually declined, progressively smaller trees have been used as sawlogs. Various lumber substitutes which do not depend on large trees, such as particleboard and waferboard, have been developed. At the same time, the reduction in the availability of sawlog-sized trees has led to increases in processing costs. Hence, in contrast to the long-term behavior of real pulpwood prices, real prices for sawlogs in North America have been gradually rising (Manthy 1977; Sedjo 1979).[7] The effects of the fall in the supply of large sawlogs in New Brunswick parallels the development elsewhere on the continent: higher prices and modified utilization standards.

Two-thirds of New Brunswick is forested with a natural cover of fir balsam and spruce, species particularly suited for making high-quality papers. Hence, the Province has been able to attract paper and pulp mills, and these have come to dominate the forest industry in the Province. However, these species -- when mature -- are also particularly vulnerable to the spruce budworm. Before the intervention of man, natural forest and spruce budworm were in finely-balanced ecological equilibrium: two or three times a century, the budworm would harvest most of the mature fir and spruce, after which these species would regenerate again to maturity and another budworm outbreak (Baskerville 1975). The budworm infestation of 1912-1921 is directly responsible for the present highly-imbalanced softwood maturity structure of the New Brunswick forest. The high proportion of mature and overmature fir and spruce has resulted from regeneration from that period and from man's partially successful efforts over the last three decades to keep the spruce budworm from harvesting timber he

wanted for himself. Paradoxically, the spruce/fir forest remains highly vulnerable to budworm outbreaks precisely because spraying has kept much of it harvestable.

Given the maturity structure of the forest and the existence of substantial budworm-damaged timber which requires salvage in the immediate future, there is no shortage of pulpwood supply at present. However, if operated at capacity, the woodfibre requirements of the Province's wood-using industry will exceed available supplies within the next twenty years. According to Watson (1983), 100% capacity operation of New Brunswick's wood-processing industry requires 8 million cubic metres of softwood annually at the present time; 25 years hence, the requirement is projected to be a quarter larger. By that time, however, the existing mature and overmature forest will have either been cut or fallen victim to budworm or old age, and the stands on cut-overs from the 1950's will not yet be ready for harvesting. Even with maximum silvicultural effort, the sustained softwood harvest at present is only about 7.2 million cubic metres.[8] After 2020, as currently immature stands develop sufficiently, supply will again exceed capacity, permitting expansion of the Province's wood-processing industry.

> In general, it appears that New Brunswick forests will suffer from a shortfall of harvestable timber supply over the medium term (20-30 years) before recently initiated forest plantations come on stream.[9]

In a nutshell, the present "feast" of woodfibre is expected to be followed by "famine" after the turn of the century, when the existing stock of mature and overmature spruce and fir will have been harvested. In turn, after roughly a further twenty years, regenerated growth from lands cut in the not too distant past should again yield adequate supplies.[10]

If imbalances between timber supply and demand in New

Brunswick could be viewed in isolation from the world market for wood and paper products, one might expect timber prices to adjust to maintain equilibrium. But, as marginal factors on world markets, the Province's wood-processors "take" rather than "make" prices. Despite local timber supply imbalances in New Brunswick, wood products from the Province will continue to be priced by world markets and returns to forest owners will tend to follow. In some parts of North America and in some less developed countries, the exploitative phase of forestry will continue for several decades yet. Although timber from those areas may be less suited than spruce and fir for paper-making, nevertheless, accessibility there will strongly influence timber prices in New Brunswick. When the old growth elsewhere is gone, plantation costs in competitive areas will determine long-run timber prices (Sedjo 1982). Since in areas such as the U.S. South, "high-yielding plantations are capable of producing 15 to 20 cubic metres per hectare per year," (Sedjo 1983, p. 81) -- five times the 3.8 cubic metres per hectare ultimately expected from intensive management in the Maritimes (Reed & Associates 1978, vol I. p. 125) -- the competitive pressures on the New Brunswick forest industry may intensify in the future. Indeed, Adams et al. (1982) have shown in a simulation study that increased timber output from intensive forest management in the United States could displace ten billion board feet of Canadian lumber imports by 2030.

To remain competitive, New Brunswick's wood-processing industry must secure more and better timber in the future; this will enable it to take advantage of economies of scale and to raise productivity. In addition, it must make better use of the timber resources available. Misutilization, the most obvious examples of which are the pulping and the use as fuelwood of softwood and hardwood sawlogs respectively, continues to be identified as a problem by people in the industry:

> If New Brunswickers are to get the greatest value out of the entire timber harvest, they must adopt a policy of sending each portion of each tree cut to its highest [most-valued] end-use, as far as this is technically and economically feasible.... The residues from these plants, along with the smaller and inferior roundwood, should supply the chemical-pulp mills, wood fibreboard plants and particleboard factories.
>
> (N.B. 1974, p. 132)

Conclusion

Forest policy in New Brunswick faces several interrelated challenges:

- inhibiting on-going budworm infestations of fir and spruce;
- coping with a threatening medium-term fir/spruce shortage;
- improving the quality of hardwood and softwood forest inventory;
- fully utilizing harvested timber; and
- in the long-run, expanding the forest resource.

These challenges to public policy arise from four sources:

- the dependence of the Provincial economy on the forest industry,
- the position of this industry in the North American context,
- ecological influences on species and maturity structure of its forests, and
- the relationship of the Province's wood-processors and owners to the forest resource.

The Province has scarcely been ignoring these policy issues. Indeed, as Chapter 4 discusses in some detail, major steps have been taken to upgrade the management of industrial woodlands in the Province. Yet private non-industrial forestlands comprise a third of the New Brunswick's forest

area. If these were more intensively managed, they could supply more pulpwood, produce higher quality trees, and hopefully yield more gross income to their owners. With no significant changes in the ownership pattern of forest lands, woodlot management could contribute to resolving some of the Province's forest policy problems. But non-industrial owners of forestlands do not see themselves voluntarily playing Santa Claus to logging and pulp interests. Forest management is expensive and uses up real and financial resources; its intensity will not readily be increased if owners anticipate that the outcome will be reduced net incomes and amenity.

To date, the major thrust of official New Brunswick policy toward the non-industrial part of their forest resource has been the encouragement of marketing boards, primarily as a way of counterbalancing the market power of wood-processors. To the extent this policy increases revenues of timber sellers, it also increases costs of wood-processors, thus reducing their competitiveness. This is a major dilemma for forest policy. It is not clear whether returns to private non-industrial forest owners can be raised sufficiently under these conditions to induce them to spend significant sums on intensive forest management.

CHAPTER 2

THE PRODUCTION OF FOREST OUTPUTS

Introduction

To follow the main line of inquiry of this study, one must understand some of the unique features of the forest economy and the terminology used in discussing it. This chapter seeks to outline in a fairly non-technical way the key characteristics of timber production and forest growth, management, and regulation. The intent is to introduce non-foresters to the bare elements of forestry economics. A more comprehensive treatment can be found in a good forest economics text (e.g., Duerr et al. 1975; or see Bickerstaff, Wallace and Evert 1981). Advanced analyses of productive relationships in forestry (e.g., Faustmann 1849; Gaffney 1962; Pearse 1967; Berck 1979; and Jackson 1980) and empirical studies of forest growth (e.g., with respect to northern conifers only, Love and Williams 1968; Carlisle and Teich 1971; Stiell and Berry 1973a & 1973b; Hooker 1977; Weetman 1977; Johnston 1978; N.S., F.P.I.B. 1980; and Ker 1981), are, of course, familiar to professionals in forestry. Such readers will find this chapter, except for its brief conclusion, an unnecessary digression; they can proceed directly to Chapter 3 without missing any essential steps in the argument.

Most studies of forestry focus on the output of timber. Most also pause briefly for a ritual obeisance to other forest outputs. Of these, watershed management is perhaps the most important, but forests also produce recreation, wildlife habitats, wilderness, and aesthetic benefits. All of these outputs are generated by the biological processes which result in tree and forest growth. These sharply contrast with the manufacture of standardized products at specific locations within relatively short periods. Forest growth is not standardized, it is dispersed, and it is slow; furthermore, it can take place without human intervention. Unlike mechanical processes involving machines and labour, the key productive inputs are the land and the existing inventory of trees on that land. The effect of adding labour and capital in forestry is to speed up growth and hence timber production, and to improve quality.

Diversity

Great diversity, involving ecological interactions with flora, fauna, water and soil, characterizes the process of forest growth. There is also diversity of ownership and land use control within forested areas. Because forests are widely dispersed, they come under differing jurisdictions and are subject to a variety of land use regulations. Public lands may be directly controlled through government departments, or may be leased to private interests subject to various controls. Lands not owned by governments are held by corporations, trusts, charitable organizations, clubs, cooperatives, partnerships, or individual owners. But the owner's exercise of control may be limited. Since owners have differing goals, differing relationships to one another, and are differently affected by government regulations, a wide range of human interaction with forestland is possible. Because forestland is dispersed, non-owners may easily trespass to hike, skimobile, camp, hunt and fish, and -- regrettably -- to cut and steal fuelwood and other more valuable timber.

A third aspect of diversity is the site. Different sites have different soils, drainage, slopes, rainfall, temperature, and exposure to sunlight. They have also had different natural histories: exposures to fires, storms, and insect infestations. As a result, they offer highly varied conditions for tree and forest development. These aspects of site diversity are natural; but man also plays a role. Harvesting critically affects a site. Earthmoving and landfilling may have taken place, cultivation may have been introduced and abandoned, erosion caused. Furthermore, as a result of road construction and the location of timber-using industries, forest sites differ greatly in accessibility for harvesting and marketing.

Nature has endowed us with an awesome variety of tree species and sub-species. Each prospers under different circumstances and is vulnerable to different diseases and insects; each has a different pattern of growth and ability to compete with other vegetation; and each possesses different "engineering" qualities of hardness, strength, density, fibre-length, graininess, porosity, and suitability as fuel. Man has learned to take advantage of these characteristics in an increasingly differentiated way, matching diversity of characteristics with diversity in utilization. Through new technologies, species once regarded as worthless or undesirable have become commercially valuable, while the relative value of other species has dropped. For example, poplar (aspen), a fast growing hardwood, was regarded in many regions as a weed until two decades ago. Now an expanding waferboard industry in the United States and Canada is based on it (Irland 198b). Traditional products such as fence posts and rails, pilings, wood shingles, rail ties, telephone poles and mine supports have become less important. Studwood and construction lumber has been supplemented by plywood, waferboard, particleboard, and flakeboard. Veneers have replaced solid woods used in furniture and panelling. Fuelwood harvests decreased steadily until the last decade, when a dramatic upsurge commenced in the

wake of the oil crisis. A primarily softwood-based paper and pulp industry has developed. Many of these changes have occurred within the time required for a single crop of trees to mature. Similar changes in use are likely during the harvest cycle of trees which are now seedlings.

Forest Growth

It is important to distinguish between the growth of individual trees, of stands of trees and of forests. The density of trees on a site strongly influences the pattern of individual tree growth. For any given site, there is a "fully stocked" density which will maximize the biological growth of the stand. Higher (overstocked) densities result in excessive competition among individual trees for light, moisture and nutrients. Some lose out in the competition and die; others grow slowly and are referred to as "suppressed". The successful trees ("dominant" and "co-dominant" in forestry terminology) have normal height, but unnecessarily small diameters and hence relatively low volumes. An understocked stand fails to use fully the nutrients, light and moisture available. The average growth of individual trees is greater than in a fully-stocked stand, but there are fewer trees, and more of the growth is in the form of non-merchantable branches. "Manipulation of stand density to optimize the tree size and stand yield balance [and to anticipate mortality] is one of the oldest and most important techniques in silvicultural management." (Bickerstaff, Wallace and Evert 1981, p. 6.)

Figure 2.1 illustrates four aspects of the growth of woodfibre volume of a so-called "even-aged" timber stand. The vertical axis represents volume or yield of the forest stand if harvested. Time measured in years is on the horizontal axis. The three solid-line curves represent different concepts of volume, the lower curves involving successively higher-valued uses for the woodfibre. The uppermost curve, B, is an estimate of the number of cubic metres of wood biomass on the site, excluding saplings with 4 centimetres diameter at breast

FIGURE 2.1

YIELDS

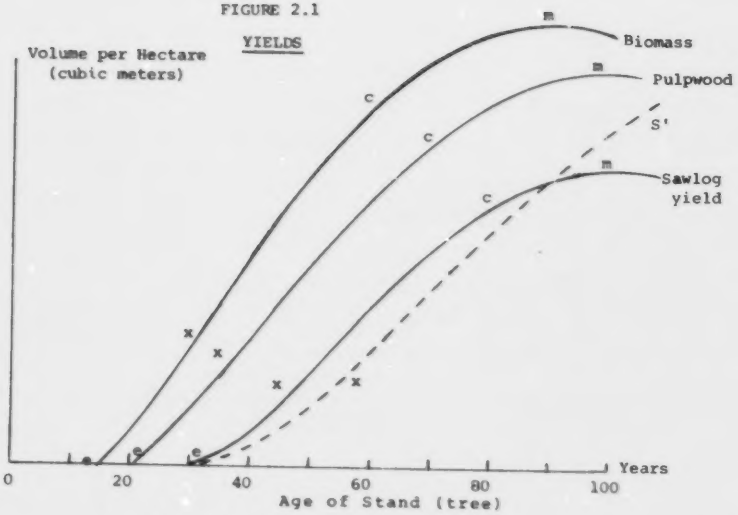
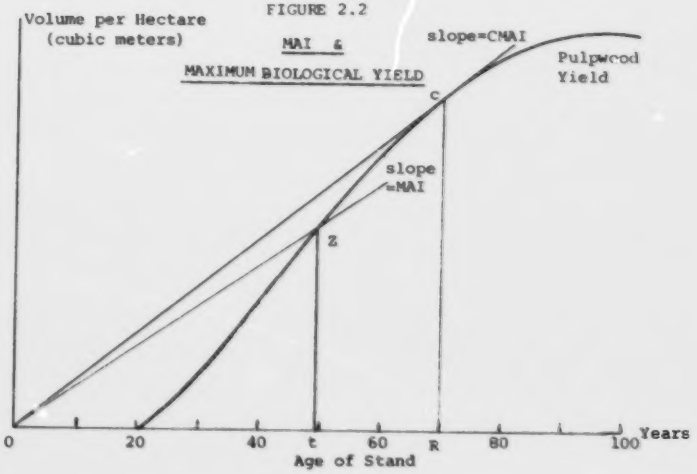


FIGURE 2.2

MAI &

MAXIMUM BIOLOGICAL YIELD



height (DBH). The curve below, P, represents merchantable pulpwood volume; it excludes trees with a minimum DBH of less than 9 centimetres. The bottom curve, S, represents merchantable sawlog volume. (A sawlog must have a minimum DBH of approximately 20 centimetres, or 8 inches.)[11] The yield increment in the current period is reflected by the slope (first derivative) of each curve. This increment includes three elements:

1. the growth of trees included in the volume definition at the beginning of the period ("accretion"),
2. the volume in trees excluded at the beginning of the period, but reaching and surpassing the minimum diameter requirements in the course of the period ("ingrowth"), and
3. a deduction for tree mortality as a result of competition, diseases and insects during the period.

On each curve four points are marked, e, x, c, and m. At point e, volume is first recognized in the stand. Thus, the distance from the origin to e reflects the time to establish the stand and the delay in recognition of volume in the stand because of minimum merchantability diameter limits. Point x is where the annual increment in the stand is greatest. Point c, as will be explained in more detail, is where the biologically maximum yield through time will be realized. Here, the rate of annual increment just equals the average growth rate of the stand from time 0. Finally, point m is the maximum volume the stand will reach if not harvested; beyond it, tree mortality and decay exceed accretion (Bickerstaff, Wallace and Evert 1981, p. 6) and ingrowth. As one moves from curve B to P to S, these four points are displaced to the right. This is a necessary consequence of more restrictive merchantibility criteria being applied.

Stand growth and tree growth differ because of tree mortality throughout the life of a stand and because of ingrowth, which will be important in the years between e

and c. The dashed line shows the growth of the dominant and co-dominant trees in the stand measured as potential sawlogs. Volume is recognized at the same initial point, but tree growth is relatively slower than stand growth until mortality in the stand becomes more important than ingrowth. Thereafter the relative volume increment of the dominant trees is greater than that of the stand. Published yield information may relate to either tree or stand growth.

Figure 2.2 reproduces the merchantable pulpwood curve from Figure 2.1. The amount of yield at any time, t, divided by the number of years to reach that time is referred to as the mean annual increment (MAI). MAI may be expressed graphically as the slope of a line drawn from the origin to the yield curve at t. In Figure 2.2, this is the slope of the line OZ. The steepest possible line drawn through the origin and intersecting the yield curve reflects the maximum or culmination of mean annual increment (CMAI). This is shown by the line OC in Figure 2.2. If the stand is harvested at time R, and thus yields RC in volume, and if the stand reestablishes itself according to the identical pattern depicted in graph 2.2, then the largest possible mean annual increment will be realized. OR is therefore the rotation for maximum biological yield in terms of pulpwood output. In a forest comprised of R stands of equal area ranging in age from 0 to R, the annually harvestable pulpwood timber volume would be RC. Typically, however, the age-structure of stands in a forest is not uniform; in such cases, forest growth is not merely stand growth "writ large", but is more complex. We touch on this again, below.

Yield diagrams such as those in the two figures may be found in many forestry texts and articles (e.g., Clawson, 1977, pp. 15, 19; Bickerstaff, Wallace and Evert 1971, p. 9, Reed & Associates 1978, V. II, p. 1-12; Hyde 1980, p. 48). Such curves and the tables on which they are based are both site and species-specific.[12] The adaptability of species to their

environments varies, as do rates of growth when young and old, and vulnerability to disease, insects, and mortality. On favourable sites, the curves in diagrams 2.1 and 2.2 will be displaced upwards and to the left; on poor sites, downwards and to the right.

It must be stressed that these yield curves relate solely to woodfibre volumes. As individual trees increase in diameter, the value per unit of their volume increases because unit harvesting costs fall and more valuable grades of lumber result. Furthermore, unit value for use as poles or sawlogs is two to three times that of pulpwood. Huber (1983, Appendices A1 and A3) analyses these relationships in greater detail.[13] Yields measured in terms of value must increase more rapidly and peak later than the volumetric curves shown in Figure 2.1. For biomass, the difference between volume and value curves will be immaterial; for pulpwood, modest; and for sawlogs, very substantial. Since the marketability of specific higher-valued products from a stand varies greatly through time as well as space, value yield curves are not only site and species-specific, but time-specific as well.

From the yield curves shown in these figures, one may derive curves which show the percentage rate of growth of a stand or a tree at various ages. Such curves may be constructed for either volumes or values. Although absolute growth per year may be constant or increasing at some stages in a stand's development, the total volume of a stand necessarily rises as growth occurs; hence percentage or relative growth rates decline as a stand ages. Figure 2.3 illustrates the relative growth rates of stand and tree volume, and stand value. Also shown is the percentage growth rate of the value of a thinned stand, which will be discussed below. The percentage rate of growth of net stand value is the key to economically optimal harvesting decisions because, if one ignores the value of future "crops" and focuses solely on the current "crop", the optimum economic point to harvest is when

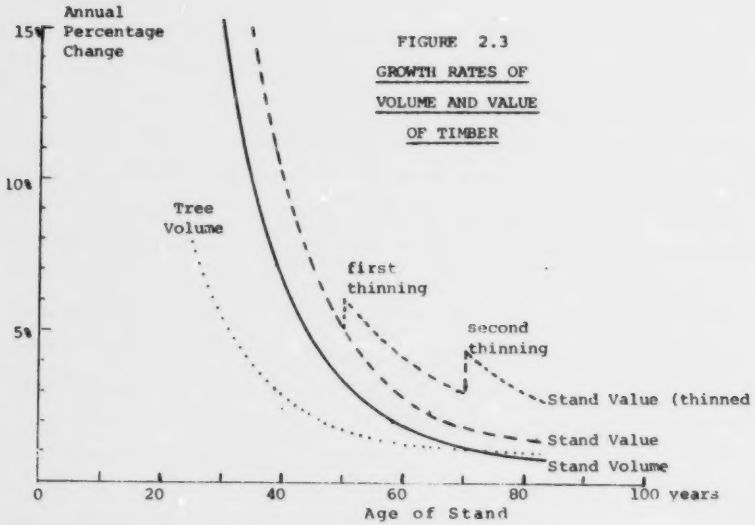


FIGURE 2.3

GROWTH RATES OF VOLUME AND VALUE OF TIMBER

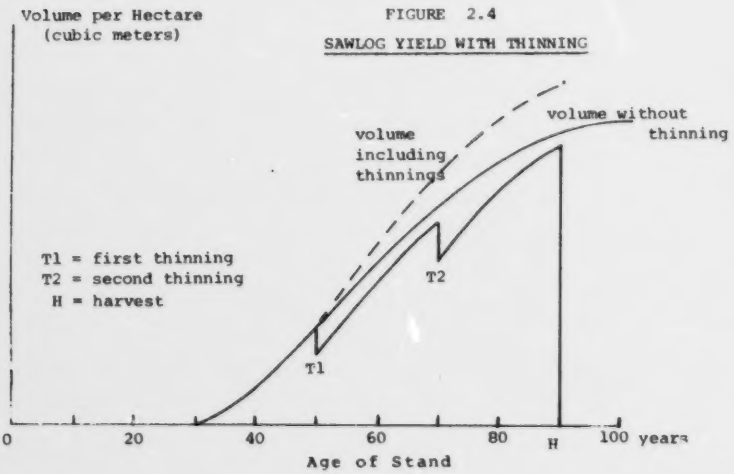


FIGURE 2.4

SAWLOG YIELD WITH THINNING

the rate of growth of the value of the stand net of harvesting costs falls below the rate of interest.[14]

To this point, we have assumed that the development of a forest stand after harvesting will follow its previous growth pattern. In reality, this is implausible. For one thing, silvicultural intervention may promote the rapid regeneration of desirable species even if a harvested area is not replanted. More fundamentally, forest succession is complex (c.f., Hyde 1980, Appendix A), depending not only on the availability, genetic quality, and climatic adaptability of seed, but also on the extent of brush, undergrowth and infant trees present when harvesting is finished (Lees 1978, pp 13-25). Distribution and disposition of slash left on a cutover, the soil disturbance from harvesting, and temperature and rainfall are influential (Frank and Bjorkbom 1973, p. 9). Interspecific competition, sprouting, and shade tolerance of particular species also play crucial roles. At least some of these variables depend on the way harvesting is carried out. For example, if only merchantable timber is cut from a site, while cull trees and undesirable species remain (a practice called high-grading), the next crop of trees may be characterized by a higher proportion of such species, and lower genetic quality. If heavy logging equipment damages advance regeneration, stand re-establishment may be delayed ten to fifteen years.

Forest Management

In its natural state, a forest will grow by itself. Forest management involves the application of economic inputs (labour, capital, and technology) in order to increase forest outputs above the amounts which would occur without significant human intervention (Reed & Associates 1978, p. 3). Intensive forest management involves a high ratio of such inputs per unit of land area, extensive management a low ratio. Under this definition, harvesting is also a form of management, but at the minimum level. An important forest output is timber, and most management has been aimed at increasing timber production

beyond what nature would yield unassisted (Duerr 1960, p. 154). However, forests can also be managed for other purposes, such as watershed protection, wildlife habitat, or multiple-use.

Management activities can be classified under five general headings, with some activities appearing under more than one:

- Site quality can be improved by irrigation, swamp drainage, and similar measures. It can be reduced through erosion or degradation caused by harvesting equipment, poorly constructed logging roads, or -- in some cases -- mere removal of the forest cover (Gourou 1947; Butler, et al. 1982). Construction of access roads also modifies the quality of a site, since costs of harvesting and silviculture are reduced.
- Quality and volume of individual trees can be influenced by activities related to stand regeneration as well as during development. Genetic selection can be practiced by planting nursery stock or by harvesting so that genetically superior trees provide seed for the next crop. Pruning, i.e., trimming lower branches to get future knot-free sawlogs, can improve quality with a lag of twenty years or so. Thinning or spacing reduces density, freeing the best trees from competition. One effect is that the trees which remain after thinning attain greater diameters, and hence become both more valuable as lumber and less costly per unit volume to harvest at maturity.
- Stand establishment can be advanced, cutting the time required for the next crop to reach maturity and be harvested. Two quite different approaches are possible; for both, harvesting procedures are important. Protection of advance regeneration during thinning and logging may promote the growth of a substantial understory, cutting the rotation period by as much as a third. This favours the regeneration of shade-tolerant species such as red spruce, balsam fir and hemlock, but may preclude the use of heavy equipment. The second approach involves site preparation through scarification, possibly followed by planting or artificial seeding.

- Stand quality can be improved by optimum spacing when planting, or subsequent thinning to favour the best trees. Diseased and malformed trees can be removed by thinning, eliminating not only their use of nutrients but also any subsequent propagation of inferior trees. Similarly, less desirable species may be removed by thinning or -- in young stands -- by herbicides favouring softwoods. When thinning is undertaken in a stand approaching maturity, the value of removals may more than cover the cost; hence this is referred to as a commercial thinning. In reducing the stocking level, thinning removes considerable woodfibre, yet the rate of growth of remaining trees may accelerate. In part this results from the presalvaging or salvaging of natural mortality: trees which will die or have died from natural causes. A further way of improving growth is the application of fertilizer.
- Finally, stand growth and survival to maturity can be safeguarded. Management activities include suppression of competing or undesirable species and brush as well as prevention or suppression of insect infestations and fire. Boundary maintenance to guard against damage or cutting by trespassers is also a form of protection.

Each of these activities is designed to improve the quantity or quality of timber output from a given site, or reduce the costs of securing it. Aside from measures which affect the accessibility of the site, most management activities shift the volumetric yield curve, and thus result in increased CMAI and a possible shift of rotation period. However, the effects on the curves shown in Figures 2.1 and 2.2 vary. Site improvement shifts the yield curve upwards and to the left, as do protection activities. Improvements in tree quality, stand quality and species composition may also shift the yield curve upwards; however, an even more important effect of these management activities is to increase the value per unit of tree volume, since an increase in the proportion of timber volume usable as sawlogs or veneer logs and a

corresponding decrease in pulpwood utilization will sharply raise revenues per unit volume. A similar comment applies to improvements in species composition. Advancing regeneration shifts the entire yield curve leftward.

Thinnings have two effects. The unit value of the remaining trees rises because competition from lower quality trees is reduced and larger trees result. However, some of the volume is removed in each thinning, introducing a series of notches into the yield curve and raising the percentage rate of growth. (See Figures 2.3 and 2.4.) A thinning operation which removes substantial volume may be "made good" by increased growth over the following 15 to 20 years, and the stand may nearly regain the volume it would have had if not thinned. This happens to a large extent because thinning removes trees which would have died had the stand not been thinned. Thus the percentage growth rate of a thinned stand may increase for two reasons: the volume of the stand (the denominator) is reduced, and the net increment of the stand (the numerator) may be raised, thanks to lowered mortality. The forest owner can have his cake and eat it too!

Forest Regulation

The key forest regulatory decision is the amount to be harvested each year, the annual allowable cut (AAC). The criterion traditionally applied in making this determination is that of maximum sustainable biological output in the context of a "normal" ideal forest. (Bickerstaff, Wallace and Evert 1981, p. 7). There are two types of such "normal" forests, even-aged and uneven-aged (sometimes called "all-aged"). One may conceive of the even-aged "normal" forest as containing as many square kilometres as there are years in the biologically maximum rotation, say 60, with each square kilometre holding a single stand of uniform (i.e., even) age, established in a different year from any other.[15] Thus the same amount of area would be occupied by trees at each stage of their life cycle, and in each year the same volume of timber would reach maturity

and be available for cutting.[16] The sustained yield (i.e., maximum sustainable annual output over time) of a forest with such a uniform structure of maturities would equal the volume on the oldest square kilometre, and would be achieved by setting AAC at that level. Harvesting would be by some form of clearcutting.

An uneven-aged normal forest will cover an identical area and have a similar overall age distribution. However, in the uneven-aged forest each square kilometre will contain a full range of ages, with seedlings, saplings and pole-sized trees growing under a nearly mature, or mature, overstory. The yield over time of the uneven-aged forest will be about the same as that of the even-aged forest, but the harvesting method must be selection cutting rather than clearcutting, with every square kilometre being selectively cut approximately every ten years. Most discussion and analysis of forest policy is carried out in terms of even-aged forest regulation, it being easier to understand and model, easier for industrial firms to manage, and overwhelmingly the most prevalent natural forest cover in Canada. However, uneven-aged forest regulation may be more suited to woodlot operations, particularly in mixed-wood and hardwood stands, since harvesting is carried out quite frequently, generating an on-going income (Irland 1979).[17]

If actual forests were "normal", and if accurate and complete inventory information were available, determination of allowable cut would be relatively straightforward. Total AAC for an entire district could then be reduced to take into account the unwillingness of some owners to harvest, the withholding of some timberland in wilderness areas and parks, and the possibility that some biomass is insufficiently valuable or accessible to be commercially exploitable. Unfortunately, accurate inventory data is expensive to gather and process (Reed & Associates 1978, p. 7), and Canadian forests are not "normal".[18]

There are four reasons why our forests have neither a

uniform maturity structure, nor an evenly distributed quality structure by maturity. First, particularly in the North and West of Canada, there remains a substantial volume of "old growth" or primaeval forest, characterized by high per acre volumes and by low or negative growth rates (Smith 1976). Second, the untouched natural forest is not "normal": fires, hurricanes, and insect infestations (e.g., spruce budworm) have periodically "harvested" large areas and upset any "normal" age distribution. Third, past cutting -- including the cutting of old growth -- has varied substantially, and resulted in an uneven distribution of regenerated forest maturities. Finally, recent (and past) management activities -- even though relatively modest in terms of the entire forest resource -- inevitably have expanded the supply of particular timber maturities, not the entire spectrum thereof.

The maximum sustainable yield of an unmanaged forest whose timber maturities do not match the ideal "normal" age structure will be limited by those maturities in shortest supply. If, as in New Brunswick, excess inventories of mature and over-mature timber seriously unbalance the age structure, maximum sustainable yield may be only a fraction of the volume which has reached the biologically optimal rotation age. Strict application of the sustainable yield principle will result in losses of production and income because of high natural mortality and low rates of net timber growth (O'Neill 1979). In such situations, which are common in Canada, "the actual allowable cuts should be substantially higher than normal in order to achieve a better age-class distribution and to transform the excess in mature and over-mature timber with little or negative net growth to more productive uses." (Bickerstaff, Wallace and Evert 1981, p. 8) However, the extent to which annual harvests should exceed sustainable yields in order to liquidate old growth and convert it into regulated forest is unclear, although this question has been addressed by a variety of more or less arbitrary allowable-cut

formulae developed over the last century (Davis 1966, chapters 6-9; Clawson, 1977; Hyde 1980). In practice however, setting AAC's above sustainable yield appears to trouble many forestry professionals.

As Talbot Page (1977) elegantly pointed out several years ago, AAC's and rotations intended to maximize sustainable yield are explicitly based on the application of biological (conservationist) criteria, from which, however, the influence of catastrophic events has been excluded (Routledge 1980; Gould 1960).[19] Balancing the forest's maturity structure, and thus gradually moving closer to the "normal" ideal is one apparently desired result of such forest regulation. Only implicitly and imperfectly is economic valuation involved in the maximum sustained yield approach. As demonstrated in the analysis of timber yields earlier in the chapter, biologically and economically optimal rotations will normally correspond only by accident; nevertheless, there is some economic content in the definitions of merchantability, accessibility (or operability) and availability. Despite the common assertion that stability of employment and income in forested areas economically justifies sustained yield regulation (e.g., Davis 1966, pp. 99-100), it is obviously an empirical question whether the benefits of such stability outweigh the costs of failing to utilize excess forest inventories. Economists have long been troubled by the absence of analyses demonstrating this, and "have argued that maximizing the sustainable yield or just maximizing the yield over a short time is economically inefficient and inconsistent with the present-value maximization of economic benefits." (Page 1977, p. 180)

Despite the clarity of Page's discussion contrasting conservationist and economic optimization, consideration of the payoffs to forest management activities continues to be confounded by confusion of the two criteria. This is most apparent in the controversy over the value of the so-called "allowable cut effect" (ACE). This effect involves a change in

the conservationist-determined AAC, the valuation of which is inconsistent with the basic principles of economic calculation (Teeguarden 1973; Klemperer 1975; and Hyde 1980, p. 20). The ACE arises on large holdings when forest management activities increase future availability of scarce timber maturities and thus improve the balance of the forest's age-structure. Non-declining sustained yield, and hence AAC, is immediately increased, the increase being dubbed the ACE. No current output expansion directly results from the management activity, since the additional trees immediately harvested under the ACE are not those directly affected by the management activity, and could have been cut in any event in the absence of the sustained yield constraint. Since the sustainable yield regulation which gives rise to the ACE is not based on economic criteria, it clearly is inappropriate to apply incremental present value calculations.

Conclusion

The orientation of the present study is primarily toward private valuations of timber, woodlands, and management inputs by non-industrial forest owners, not social valuations by government. The perspective is economic, not conservationist:

> under a market test, or under the efficiency criterion, exploitation would not be carried further than the point where an incremental increase in management and exploitation costs is larger than the resulting gain in the [present] value of the yield.
>
> (Page 1977, p. 180)

This point of view is neither arbitrarily chosen nor a matter of the personal biases of the author. It is dictated by the issues the study addresses: whether economic incentives of various types will induce woodlot owners to engage in substantially increased forest management activity. An examination of the economic motivations of timberland smallholders must start with the presumption that such forest

ownerships are not integrated in any way into an industrial timber-processing operation, and must accept that most of the owners of these modest-sized holdings are being expected to react to economic stimuli.

CHAPTER 3

THE MARKETS FOR WOODLOT TIMBER IN NEW BRUNSWICK

Introduction

This chapter and the one following consider the effect of government policy in New Brunswick on the amounts owners of non-industrial forest holdings (woodlots) receive from cutting timber. Chapter 4 focuses on one aspect of this: the influence of the recent Crown Lands and Forests Act on wood-processors' demand for woodlot timber. The present chapter seeks to analyse the economic linkages between that demand and the resulting prices of woodlot-sourced timber delivered to wood-processing plants on the one hand, and the returns to woodlot owners on the other hand. These linkages are conditioned by varying degrees of vertical integration in producing timber and processing wood, by the operation of statutorily-authorized timber marketing boards, and by institutional and geographical factors. The remainder of this introductory section sketches the structure of marketing relationships. Then the roles of non-industrial timberlands, the wood-processing industry, and the marketing boards are described. A formal analysis of the timber market under the conditions described is developed in the Appendix to this chapter; this is mirrored in the informal analysis and

conclusions in the last two sections below.

One may identify four separate stages in the production of forest-based products: timber-growing, timber-harvesting, timber-hauling, and wood-processing (Runyon 1983). There are also sub-stages: for example, the intermediate storage of harvested logs, the sorting of logs according to use, and the use of residues such as chips and sawdust from one processing plant by another of a different type. Some entrepreneurs may be specialized, conducting their activities at a single stage only; others may be vertically integrated, either partially or totally. Major firms may operate pulp and saw mills, own and manage substantial forest acreage, and handle their own harvesting, transportation and processing. Firms with no pulp or paper-making capacity, may also be vertically integrated with respect to inputs, while selling undersized logs and processing residues to a pulp-making firm. In New Brunswick, the major wood-processors (and two other firms) license and operate Crown land; most wood-processors also purchase raw materials cut from non-industrial lands. Although controlling various stages of production, firms may contract out harvesting and hauling. Since large firms are generally unionized while contractors are not, contracting-out reduces costs and increases operational flexibility. It is common knowledge in New Brunswick that some contractors have been assisted in entering the industry by one or another of the large firms, thus creating an element of mutual -- though unequal -- dependence.

Correspondingly, woodlot owners may do their own cutting, some may harvest as well as haul, some may partially harvest and haul. Other owners will contract for cutting, hauling or both. Furthermore, it is not uncommon for woodlots with standing timber to be sold to contractors or to sawmills, who then (or later) log the lot. Few owners make a living by growing timber, while many participate in the forest industry as brokers, contractors, haulers, or employees of

forest-product companies. Multiple roles, and permutations and combinations of vertical integration are prevalent. Hence, to focus on growing timber in isolation from other possible activities of owners is difficult. Nevertheless, unless indicated otherwise below, references to woodlot owners should be taken to mean unintegrated owners who do not log or haul timber.[20]

The stages in the production of wood products are obviously linked, particularly with respect to the quantities flowing from one stage to the next. At each stage, supply and demand relationships yield a price (for "unintegrated" product transactions) which will vary according to the number and economic strength of the participants on opposite sides of the market at that stage. The value of the standing timber on the stump (and consequently, the gross return to the unintegrated owner of the timberland upon harvesting) is called "stumpage".[21] After felling, bucking into lengths, forwarding to roadside and stacking, the cut timber is priced "at roadside". The roadside price includes the gross return to logging plus the stumpage. The "millgate" or "delivered" price includes the costs of hauling (and loading and unloading) and thus comprises three elements: gross return to hauling, gross return to logging, and stumpage. At present, the delivered price of roughly $65 per cord for pulpwood is divided approximately thirty percent to hauling, one-half to logging, and one-fifth to stumpage.

Traditionally, large and middle-sized wood-processing firms purchased woodfibre (whether for pulp or other uses) at millgate or at roadside, although virtually all were prepared to buy well-located woodlots with standing timber or cutting rights, and some purchased stumpage. Sometimes intermediaries -- dealers, brokers, middlemen -- were involved. These would arrange for cutting and delivery, and perhaps prepay the woodlot owner for all or part of the stumpage. The intermediary would also find the best market among competing

purchasers, and either pocket any price differential or share it with the owner. The advent of marketing boards in New Brunswick has largely eliminated the functions of the broker or dealer -- although marketing boards have been reluctant to pre-finance sales of timber.[22] The boards have focused on negotiating delivered prices with the major wood-processing firms, who absorb at least two-thirds of the annual deliveries from woodlots. In some marketing board areas, roadside prices have also been negotiated, thus establishing a maximum margin for hauling. Despite expressed willingness of some large firms to negotiate stumpage rates, no marketing board has sought to fix these.

Small Private Woodlots

Table 3.1 shows the distribution by ownership type of New Brunswick's forests and the volumes of merchantable timber in those forests; output from such holdings is also shown, but is gathered on a statistically different basis, and hence not entirely comparable.[23] The table shows that the Province's 40,000 smallholders own about a third of the forested land. However, the volume of timber per acre (or hectare) on small freeholds (woodlots) is only about four-fifths of the Provincial average, and the softwood volume only two-thirds. Furthermore, the proportion of sawlogs on woodlots is far less than on private and public industrial holdings. Three factors may explain these disproportions:

1. Crown land, large freeholds, and small freeholds are unevenly distributed within the Province; moreover, the natural cover of forestland and its timber-carrying capabilities vary regionally. We document this below.
2. Exploitative cutting practices on woodlots have led to hardwood encroachment and reduced inventories.
3. Excessive acreages of overmature timber on Crown land (mentioned in Chapter 1) imply abnormally high average volumes per acre.

It is sometimes alleged that only half the small freeholds

TABLE 3.1

FOREST STATISTICS BY OWNERSHIP IN NEW BRUNSWICK

		Small Freehold	Large Freehold	Crown	Provincial Total
Productive Forest	Km^2	20550	10970	29282	60802
	Acres x 10^6	5.078	2.711	7.236	15.024
	% of Total	33.8%	18.0%	48.2%	100.0%
Volume of Inventory*	m^3 x 10^6	140.44	107.43	267.95	515.82
	% of Total	27.2%	20.8%	51.9%	100.0%
Softwood Percentage		56.6%	61.5%	71.5%	65.4%
of which, sawlogs+		31.8%	45.4%	37.1%	37.5%
Volume/Area	m^3/hectare	68.3	98.0	91.5	84.8
Softwood Only	m^3/hectare	38.7	60.3	65.4	55.5
Harvest*	m^3 x 10^6	2.38	2.02	3.74	8.14
Softwood Only	m^3 x 10^6	1.96	1.64	3.33	6.93
Softwood Percentage		82 %	81 %	89 %	85 %

Sources: DNR-FMB. 1981. New Brunswick Forestry Inventory.
DNR-FUB. 1982. Forest Utilization Survey.

\+ : DBH = 26 cm. or more.
* : Five-year average, 1977-1981; excludes home firewood and exports.
x : Merchantable, with DBH of 11 cm. or more.

Note : Harvest and volume data cannot be matched for small and large freeholds since inventory and utilization data are based on inconsistent definitions.

are harvested (and these overcut), the remainder being withheld by owners who have goals other than timber-growing (N.B. Legislature 1981). Although half the woodlot owners may not cut, the generalization that half the woodlot acreage is not cut appears inconsistent with the volumetric percentages harvested on the various types of holdings. About 2.5% of available softwood on private timber acreage is being cut annually on average. Applying this percentage to non-industrial holdings implies that the available half of woodlots would have been cut over 20 years, and no further supply be forthcoming for the following 20 years (assuming a 40 year rotation). Put differently, the effective five percent per annum rate of cutting on the half of woodlots subject to harvest would be three times that on Crown land and twice that on large freeholds. These implications do not accord with the impressions of knowledgeable persons on marketing boards. Nor are they consistent with the findings of the New Brunswick Nonindustrial Private Woodlot Owner Survey (Roy 1983), which found that 38% of owners with 53% of the woodlot acreage had sold products in the past five years and 72% of owners intended to harvest in the next five. Nor, finally, are they supported by the available age-structure data for woodlots (N.B. P.W.R.S. 1983, p. 54).

Table 3.2 shows the ownership pattern by resource region in New Brunswick. 55% of the Crown land is in regions 1 and 2, the North Shore and Miramichi, where it comprises three-fourths of the acreage. Two-thirds of the small freeholds are in southern New Brunswick, where they constitute one-half the acreage; and four-fifths of the private industrial (large) freeholds are in the west, where they account for almost a third of the acreage. Regarding species distribution, on the North Shore and along the Miramichi (resource regions 1 and 2), nearly 60% of the forest is spruce and fir and under 30% is hardwood; while the south (resource regions 3 and 4), spruce/fir and hardwood proportions are nearly equal. However,

as Kilpatrick (1982) has shown, small freeholds in every region have lower merchantable softwood volumes per acre than average, and higher proportions of hardwood volume.

TABLE 3.2

PRODUCTIVE FOREST AREA BY RESOURCE REGION AND OWNERSHIP

NEW BRUNSWICK
(in square kilometres)

Region	Small Freehold	Large Freehold	Crown	Province
North Shore	2382	70	8017	10469
Miramichi	2463	829	8100	11392
Southeast N.B.	7498	1207	4816	13521
Southwest N.B.	5788	4230	4231	14249
Upper St. John Valley	2419	4634	4118	11171
	20550	10970	29282	60802

Source: DNR-FMB. 1981. New Brunswick Forest Inventory.

Note : Definitions of resource regions overlap with licensee holdings and marketing board areas.

Two-thirds of the woodlots are less than 100 acres in size; yet holdings of 250 acres or more comprise 40% of the non-industrial privately-owned forestland.[24] As Table 3.3 shows, there are regional variations in woodlot size. The average holding ranges from 120 acres (50 hectares) in the southwest to half that size on the North Shore. About a tenth of woodlot acreage is owned by non-residents, and the sizes of non-resident holdings are about the same as those of residents, regardless of region.

Wood-Processors: The Purchasers of Timber

In New Brunswick, there are ten paper and pulp mills with an aggregate annual capacity of about 2.2 million tons. Seven mills, accounting for three-quarters of the capacity, use strictly softwood. The Bathurst mill uses some hardwood as well, while the Nackawic and Lake Utopia mills rely primarily

TABLE 3.3

WOODLOT OWNERS AND ACREAGES IN NEW BRUNSWICK
BY MARKETING BOARD AREA

Marketing Board	Resident Owners			Non-Resident Owners		
	Number	Acres	Acres/Owner	Number	Acres	Acres/Owner
Madawaska	2,091	213,704	102	198	18,915	98
Carleton-Victoria	3,736	366,195	98	361	33,328	92
York-Sunbury	5,874	711,508	121	555	72,628	130
Southern N.B.	6,470	791,951	122	595	67,023	112
Southeastern N.B.	7,159	525,065	73	798	62,481	78
Northumberland	3,564	284,874	80	408	31,846	78
North Shore	6,668	400,170	60	629	47,570	76
	35,562	3,293,467	93	3,544	333,791	94

Source: 1980 N. B. Timberland Tax Lists (quoted in NBFWO 1982a).

Note: 2.471 acres = 1 hectare.

upon hardwood. The Irving group is the largest factor in the industry, with six sawmills and three pulpmills (two in the Saint John area, and the Lake Utopia mill at Saint George, a hundred kilometres along the coast to the west). The Fraser Company is the second largest with two pulpmills and two sawmills in the northwest corner of the Province. Irving and Fraser together account for one-third of the pulp mill capacity and nearly one-half of the sawmill capacity. Table 3.4 shows the pulpmill and sawmill capacities of the firms with licenses to manage Crown forests in New Brunswick. These are referred to in the next chapter as Crown "licensees." In addition to this wood-processing capacity, medium-sized firms operate 14 sawmills, each with a capacity of at least 5 million board feet per year; and several dozen smaller Provincial firms make a variety of wood products. These minor firms are called "sub-licensees".25

The large firms which operate pulp mills own approximately one-sixth of the forest area of the Province, and are also entitled under their Crown licenses to about three-fourths of the timber cut from Crown land. In late 1984, as this text was being revised, Acadia Forest Products was in the process of taking over the Boise-Cascade mill in Newcastle. With this development, each of these six firms has achieved geographical isolation from competition for raw materials. This is not accidental, but normal for pulpmills (c.f., Lowry and Winfrey 1974); such operations have high capital costs and hence, once located, cannot readily move to improve access to raw materials. Analytically, this is significant: when buying pulpwood, these large firms can exercise market power (i.e., act as oligopsonists). Although this proposition is deduced from industry structure, there is readily available anecdotal evidence of oligopsonistic behaviour, for instance, reprisals by major Provincial wood-processing firms against other firms who have "poached" by buying timber outside their "own" territories.

TABLE 3.4
WOOD-PROCESSING CAPABILITIES OF
MAJOR FIRMS IN NEW BRUNSWICK
1980

Firm	Paper/Pulp Mills number/capacity (thousand tons)	Sawmills number/capacity (million board feet)
Fraser	2/415	2/90
Juniper	-	2/30
Valley Forest/ Ste Anne Nackawic	1/245 HW	1/8
Irving-MacMillan	3/720*	6/143
Boise-Cascade	1/180	-
Acadia	1/130	1/8
Consolidated Bathurst	1/190	1/25
NBIP	1/280	-
Northwood+		
Major sublicensees		14/110
Minor sublicensees++		60/75?

* SW capacity 2/630; HW 1/90
\+ Waferboard plant currently shut down.
++ There are also a dozen sublicensees operating other types of wood-processing facilities.

Note: includes subsidiaries
Sources: NBFWD 1982b. Negotiations Material
N.B., Private Woodlot Resources Study, unpublished papers

Unlike buyers' markets for pulpwood, which, because of high fixed costs of entry and exit are not "contestable" (Baumol 1982), saw-timber markets can be contested by buyers, since small sawmills can be moved at modest cost. But, given the economies of large-scale modern sawmill operation and the corresponding decrease in "footlooseness", given the integration of pulpmill and sawmill operations and the dominance of the latter by Crown licensees, and given the general dependence of the New Brunswick timber industry on pulpwood, a significant degree of oligopsony should be expected in the Provincial market for saw-timber as well.

Marketing Boards

In most of New Brunswick the sale of unprocessed timber from private woodlots is controlled by marketing boards. The oldest of these, the Madawaska Forest Products Producers' Marketing Plan, was established 20 years ago in the northwest corner of the Province under the Natural Products Control Act. Two additional boards were established in 1973 and 1974 in the north; the remaining four boards were set up in the last eight years under the Farm Products Marketing Act and the Forest Products Act. Marketing boards now blanket the Province, except parts of three counties at the mouth of the Saint John River. An umbrella organization, the Federation of Woodlot Owners, represents the members of marketing boards at the Provincial level.

The regulations setting up these marketing boards under statutory authority are broadly similar, but there are a number of important differences in membership criteria, voting, and range of application of the marketing regulations. Generally, if a majority of the forest industry participants ("producers") involved in marketing primary forest products from woodlots in a district vote in favour of a marketing board, either an existing board is expanded to include them, or a new one is set up under its own regulations.

> 4(1) Where the [Forest Products] Commission receives a request from a group of producers who market..., if it is of the opinion after investigation that such a group is fairly representative ..., may recommend to the Minister that a local board be established, and may prepare a [regulatory] plan with respect to that farm product.
>
> (N.B. Farm Products Marketing Act)

The term "producer" is not defined in the Act, and the regulations for the seven marketing boards are inconsistent. But the Act does define "marketing" sweepingly to include buying, selling, advertising, financing, storing, assembling and hauling. Hence, what constitutes an appropriate "group" under clause 4(1) is subject to interpretation. Each marketing board is legally authorized to bargain collectively for its area with all potential purchasers of unprocessed timber in New Brunswick, to require the licensing of some or all timber marketers, to collect fees, to buy and sell the regulated products, to enforce its regulations, and to make such orders as it deems necessary to regulate the marketing of primary forest products from its area effectively. However, in most areas, owners, growers, and producers are not regulated insofar as they are not involved in "marketing". Thus, from a legal point of view, the marketing boards are oriented to controlling the marketing of timber from woodlots, not the growing or harvesting of that timber. Although it appears that marketing boards do not fully exercise their powers, essentially they are local cartels.[26]

As noted above, the marketing boards have concentrated on fixing delivered prices for timber. Their bargaining position in this respect was greatly strengthened in 1979 by the introduction of specific deadlines for commencement and completion of negotiations with the major wood-using firms (Regulation 79-149 under the Farm Products Marketing Act). If an agreement has not been reached by March 15th in each year,

the Government may -- on the recommendation of its Forest Products Commission -- suspend the cutting rights of the Crown licensee involved (Regulation 79-150 under the Forest Products Act, and section 13 of that Act). Since half of the total harvest comes from Crown land, this provision involves a potentially severe penalty for Crown licensees who drag their feet in negotiations.

One might suppose that woodlot owners -- timber-growers -- are to be the primary beneficiaries of this regulatory system. However, loggers and haulers generally have substantial investments in equipment and therefore an immediate economic interest in influencing the affairs of marketing boards to their benefit. Those who are strictly owners of timberland generally have much less interest, because medium-sized and small woodlots can be partially harvested only once every five to fifteen years at best. For these reasons, loggers and haulers are likely to involve themselves more energetically than timber growers in marketing board activities. It is not surprising that some of the marketing boards appear dominated by loggers and timber haulers (who often are incidentally owners as well).

However, this natural result of the workings of economic interest is reinforced by the regulations in all marketing board districts except Madawaska. The key provisions regarding the qualifications of board members and those of the marketing "participants" who directly or indirectly elect them are set forth in columns 6 through 9 of Table 3.5.[27] Voting is on the basis of one man equals one vote, once the minimum sales and forest ownership requirements are met; but in Madawaska registered dealers (potentially, anyone buying and selling primary forest products) are excluded from membership on the board, and timber sales from the area are required for participation and election. Elsewhere, wood haulers, brokers, loggers and dealers will be able to participate by buying a small woodlot. Indeed, in the three marketing board areas in

TABLE 3.5

MARKETING BOARD REGULATIONS: RANGE OF APPLICATION AND QUALIFICATIONS OF ELECTORS AND BOARD MEMBERS

Marketing Board	Application of Marketing Plan to				Elections to Local Marketing Board Participants' Qualifications			Board Members Qualifications
	Owners	Growers	Producers[1]	Other[2]	Sales Under Plan	Forestland Ownership	Production in Area[4]	Same as Elector
Madawaska	?	Yes	Yes	Yes	Yes	No	Yes	registered dealers excluded[5]
Carleton-Victoria				Yes	No[3]	No	No[3]	Yes
York-Sunbury -Charlotte				Yes	No[3]	No	No[3]	Yes
Southern N.B.				Yes	No[3]	25 Acres	No[3]	need not own 25 acres
Southeastern N.B.				Yes	No	25 Acres	No	Yes
Northumberland			Yes	Yes	No	25 Acres	Yes	Yes
North Shore			Yes	Yes	No	25 Acres	Yes	Yes

[1] Undefined

[2] Forest Entrepreneurs - Buyers, sellers, transporters, shippers, storers, assemblers, dealers.

[3] Elector must "market" under the plan, i.e. be a forest entrepreneur of some sort.

[4] Meaning of "Production" (timber growing or timber harvesting?) is unclear; cutting rights must be held.

[5] Registered or licensed dealer may be defined by the Board.

Sources: N. B. Regulations under the Natural Products Control Act (#113, #73-83, #74-96) and Regulations under the Farm Products Marketing Act (#77-112, #78-102, #79-144, #80-150, #81-164, #81-188, #82-27, #82-52)

the west, there is no requirement that forest land or cutting rights be owned, and for the four marketing boards in the south and west there is no requirement to produce forest products in the area. Thus, in Carleton-Victoria and York-Sunbury-Charlotte, participants and board members need neither to own forestland nor to produce or sell forest products from the area, since there a "producer" is any person or firm marketing unmanufactured forest products (except maple syrup, cream, and sugar) produced from non-industrial forest land. This definition excludes many owners of timberland whose forest stands are too young and who have not recently "marketed"; it includes brokers, haulers and loggers (and even lenders with respect to timber purchases) who own no forest land.[28]

Although marketing boards do appear to have kept some potential supply from entering the market, it is unclear whether they have caused delivered prices to rise. Over the past dozen years, delivered prices for pulpwood trebled in New Brunswick, but differences between areas which had marketing boards over the entire period and areas which established boards during the period are slight. However, formation of a board in a neighboring area may have caused prices in an unorganized area to be higher than would otherwise have been the case. Moreover, the "normal" regional supply of timber in New Brunswick has been upset by the uneven distribution of budworm damage on non-industrial holdings.

With respect to quantities, Table 3.6 outlines the relationships among the major wood-processing firms in New Brunswick and the marketing boards, showing the annual allowable timber harvest from Crown land for 1982-83 and the contracted volumes between these companies and marketing boards for the same period. Since the territories in which marketing boards operate overlap with the areas from which major firms draw their timber supplies, most of the firms deal with two or three marketing boards, and each marketing board deals with at least two major firms. These overlaps are graphically apparent

TABLE 3.6

APPARENT TIMBER SUPPLY TO MAJOR FIRMS (LICENSEES)
FROM CROWN LAND AND MARKETING BOARDS
1982-83
(in cubic metres)

Licensee	Crown AAC	Contracted Volumes Marketing Boards	
		Volume	Number
Fraser (Edmunston)	676,367	292,827+	3
Juniper	195,462	45,921	2
Valley Forest (Nackawic)	474,162	187,885	3
of which as Licensee	(250,321)		
Irving (Saint John)	578,410	440,658	3
Irving-MacMillan (Rothesay)	252,235	269,613	3
Boise-Cascade (Newcastle)	497,595	251,538	4
Northwood (Chatham)	131,560	(shut down)	3
Acadia (Nelson)	266,960	69,800	3
Consolidated-Bathurst	342,843	117,404	2x
N.B. Int'l Paper (Dalhousie)	416,257	48,139	1x
	3,831,850		

\+ open volumes of sawlogs contracted for
x also purchases in Quebec
AAC annual allowable cut

Sources: NBFWO 1982a. Annual Report, & calculations based on
N.B. Private Woodlot Resources Study, unpublished papers.

in Figure 3.1, which shows the resource regions, the marketing board areas and the Crown licensee supply areas of major firms in the Province. In general, the marketing board contracted volume is about 40% of the Crown volume; only for Irving is the proportion significantly higher. For NBIP and Acadia it is noticeably lower. This results from the Crown harvest allocation described in Chapter 4.

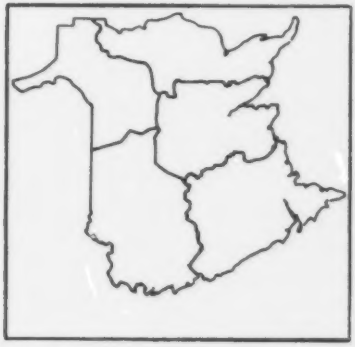
Three points emerge from Table 3.7, which shows the relative sizes of the various marketing boards in terms of contracted volumes and estimated annual allowable cut (AAC) of woodfibre from woodlots. First, the contracted softwood volume exceeds AAC in four of the seven marketing board areas; in a fifth, Madawaska, it roughly equals AAC. Second, there appears to be an excess of softwood available for cutting on the North Shore. Third, the contracted volume of hardwood ranges from nil to half estimated AAC. In the south and southeast, where there is the greatest amount of hardwood inventory on woodlots, there is no contracted volume of hardwood sales. Neither Irving nor Valley Forest, both of whom operate hardwood pulpmills, had hardwood delivery contracts with these marketing boards in 1982-1983.

Marketing Woodlot Timber: Quantity, Prices and Delivery Tickets

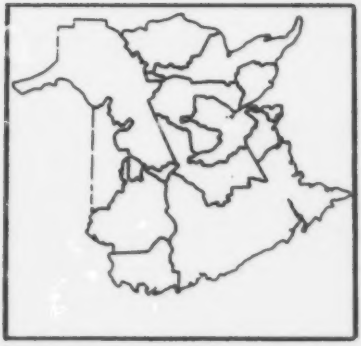
What is the economic link between delivered prices and the gross return to forest ownership in New Brunswick? Clearly the difference between these is the gross return flowing to haulers and loggers (collectively, contractors). Their operating costs as well as the powers exercised on the markets by processors, contractors, and marketing boards determine the linkage. In the previous sections, we discovered that major wood-processing firms are oligopsoonists vis-a-vis their suppliers. Marketing boards have negotiated both (delivered) prices and quantities, and excess supplies have resulted. Geographical price-discrimination has been accepted by some boards, and contractors appear to have an advantage in setting stumpage rates. Furthermore, the market for stumpage is highly

FIGURE 3.1

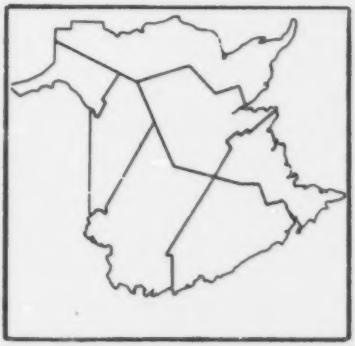
Boundaries of Forest Administrative Regions,
Crown Licenses, and Marketing Boards in New Brunswick



Forest Administration Regions



Crown Timber Licence Boundaries



Forest Products Marketing Boards

Source: N.B. Private Woodlot Resources Study (1983), p. 77.

TABLE 3.7
CONTRACTED AND ANNUAL ALLOWABLE CUTTING VOLUMES
FROM WOODLOTS BY MARKETING BOARD AREA
(in cubic metres-stacked)**

Marketing Board Area	1982-83 Contracted Volumes				1983 AAC	
	Total	Per Hectare	Softwood	Sw/Hectare	Total	Softwood
Madawaska	252,888	2.7	199,353	2.1	442,926	209,502
Carleton-Victoria	413,574	2.6	271,994	1.7	606,396	286,343
York-Sunbury-Charlotte	686,079	2.1	543,936	1.7	946,383	459,600
Southern N.B.*	393,447	1.2	393,447	1.2	574,862	296,130
Southeastern N.B.	408,221	1.7	408,221	1.7	565,800	310,628
Northumberland	636,048	2.1	261,964	2.1	331,288	209,502
North Shore	395,484	2.1	232,377	1.3	666,201	377,683

* The area used for this Marketing Board includes all of Saint John, King's and Queens Counties. However, the contracted and allowable allocation figures relate solely to the Marketing Board Area, which includes only half the territory.

** Metric equivalents calculated on the basis of one cord equal to 3.625 cubic metres-stacked. Depending on species, quality, and length of pieces cut, a stacked cubic metre is approximately five-eighths of a solid cubic metre.

SW Softwood
AAC Annual Allowable Cut
Sources NBFWO. 1982a. Annual Report
NBFWO. 1982b. Negotiations Material

intransparent, i.e., a market for which accurate information regarding prices paid, quantities transacted, and precise characteristics of commodities traded is not readily available to actual and potential participants. To analyse these factors properly, one must first identify the determinants of pure stumpage rates, excluding any access, felling, and delivery activities of owners.

Under competitive conditions, the demand for stumpage from any given location will vary with characteristics which are site-specific and fixed in the short run. Stumpage rates (or total stumpage for a lot) negotiated between contractor and owner will relate generally to the volumes of woodfibre cut or expected to be harvested from the woodlot, their quality, distribution by species, and accessibility. Other key influences are distance to a wood-processing facility where the woodfibre will be used, the unit operating costs of logging contractors and haulers, and current prices of wood products (e.g., pulp and lumber). Only this last factor, derived ultimately from the demand for wood products, will vary in the short run.

And what of supply? It is important to distinguish the sale of stumpage from the activity of growing forest products. The former corresponds to short-run or market period supply in economic analysis, the latter to long-run supply. Short-run returns to the owner from contracting to have his woodlot harvested depend on the volume sold, and the unit prices. Stumpage sales are made from the living forest inventory, in which quality and species composition can be treated as fixed over periods up to a year or more. There are no explicit short-run costs to the owner, other than arranging to hire a contractor. Implicitly, however, the owner must consider the returns foregone by cutting currently rather than waiting to take advantage of the increment of growth and possibly more favourable markets. (The owner's short-term financial situation and the amount of selling "persuasion" exerted by

contractors will also play roles.) Thus, willingness to cut depends on how the owner perceives current and future demand and whether he regards the timber on his woodlot as an asset convertible into cash.[29] Implicit (i.e., "opportunity") short-run costs to the seller of stumpage arise only because of the existence of demand which is deemed to extend beyond the present.

In the short-run, therefore, subject to a minimum reservation price reflecting perceived long-run possibilities, the value of stumpage on any given site will be a residual, a "pure economic rent", determined solely by demand factors, the most variable of which is the demand for timber deliveries by processors of wood. (By the same token, the value of land which has no use except for forestry is determined by the value of the wood-products which can be secured from it.)[30] Market power exercised by processors and by contractors will aim at capturing a portion of this residual. For example, by taking less care in harvesting, the residual can be increased and partly captured by the contractor: the costs of harvesting are sensitive to the quality of construction of access roads, the care taken to avoid erosion and damage to young growth, the extent of removal of non-merchantable cull species and trees, and the clean-up of the harvested site. Of course, the volume, quality, and timing of timber supplied in the next rotation will all be negatively affected by precisely such harvesting shortcuts.[31]

If efforts by processors and contractors to capture a portion of the residual are successful -- as appears to be the case -- short run fluctuations in demand for woodlot timber may lead to corresponding variations in stumpage rates on lands which would in any case have been harvested. In addition, however, variations in the acreage harvested will also occur and stumpage will be paid on this marginal acreage. As a result, total stumpage revenues will move in sympathy with the demand fluctuations, but not necessarily disproportionately, or

even proportionally. Hence, average stumpage rates need not change, and may even move inversely with respect to demand.

When a cartel (i.e., marketing board) controls the marketing of a product, any success the cartel may have in increasing the price on a formerly "competitive" market must result in excess supply and the necessity for quotas or some other administrative device to allocate deliveries among potential suppliers. If the cartel operates under conditions of monopsony (a single buyer), this result is not inevitable, but will occur in some cases. If demand fluctuates but price of delivered pulpwood is fixed by agreement between a monopsonistic buyer and a marketing board, then the amount sought to be supplied will sometimes exceed or fall short of the quantity expected to be delivered from woodlots at that price. Three reactions are possible in this context: the wood-processing firm may vary the harvest of industrial forests under its control so as to reduce or eliminate the fluctuation in demand for woodlot timber (an action inhibited by the CLFA, as shown in the next chapter); the firm or its suppliers may accumulate or reduce inventories; or an alternative mechanism may be introduced to match supply to demand and thus "ration" deliveries if there is a surplus, or "ration" demand if there is a shortfall. If fluctuations in demand are large, the third possibility becomes almost unavoidable.

In the absence of marketing boards in New Brunswick, the dominant firms might still have found it convenient to maintain fixed delivered prices over periods long enough to encompass substantial variations in demand (c.f., Lowry and Winfrey 1974). Furthermore, they may have needed to schedule deliveries to prevent excessive inventory build-ups. Hence, they might have required a system to ration deliveries. With marketing boards, a rationing system becomes even more necessary. One important effect of establishing such a system to maintain fixed delivery prices despite demand fluctuations is that a further disjunction or separation between delivered

and stumpage prices is introduced.

While a complete empirical investigation of the systems of all major firms has not been conducted, it appears that most -- if not all -- control woodlot deliveries by means of delivery "tickets," each of which entitles the holder to deliver a truckload of pulpwood (to a particular firm) on a particular day in the near future. When the amount of deliveries desired by loggers (or haulers) is greater than the amount which the pulpmills will accept, possession of a ticket has economic value and enhances bargaining power. If tickets are distributed to contractors or haulers -- which is generally the case -- they become temporary local monopsonists and can pick and choose among woodlot owners, forcing stumpage rates downwards.[32] They can also afford to increase efforts to persuade owners to sell. Although the number of woodlot owners far exceeds the number of contractors, if owners should receive the tickets, the reverse situation would tend to prevail. Essentially, on a perfect and transparent market, any excess of delivered prices negotiated by the marketing board above the level which otherwise would prevail in the absence of negotiations would go to the holders of the delivery "tickets". Under the control of contractors, a "ticket" system transfers some market power from the major firms, but does not benefit unintegrated woodlot owners. Furthermore, if competition among contractors is prevented or reduced by marketing board regulations or practices, such woodlot owners can be squeezed out of more stumpage revenue than would otherwise be possible.[33]

Yet even without a ticket system, woodlot owners would be at a disadvantage in negotiating with contractors regarding stumpage, because most woodlot owners sell infrequently and are not familiar with the current markets for their forest products, whereas contractors harvest regularly. Furthermore, owners may find it difficult to supervise cutting operations to ensure that slash is properly cleaned up and good regeneration

is not inhibited. Because of variations in contractors and owners, one might expect the lack of transparency of the market for stumpage to result in substantial variations in stumpage on woodlots with similar characteristics. There is considerable anecdotal evidence that this is the case, but little sound statistical information on the stumpage rates actually being paid. The Appendix to the Chapter develops many of the points in this section more formally, using a diagrammic analysis.

Conclusion

Consider now the effects of a government policy which indirectly results in a long-term increase in the demand by wood-processing firms for woodfibre from woodlots. Such a shift in demand will show up at millgate or roadside, and will result in higher quantities and delivered (or roadside) prices negotiated between the marketing board and the company in a given area. Presumably, a larger quantity purchased at either of these "locations" will imply a larger quantity of stumpage sold. However, the same relationship does not necessarily hold for stumpage prices, when the timber market is under the influence of a marketing board system. It is entirely possible for the delivered price of pulpwood to rise without influencing average stumpage rates; indeed a number of industry participants suggested that this had in fact occurred in recent years. For one thing, logging and hauling costs may on average be substantially higher for the additional timber delivered. Moreover, as noted earlier, a woodlot owner's willingness to harvest depends not only on the stumpage price, but on his short-term financial circumstances, the amount of "selling" persuasion by contractors, the rate of change in the perceived value of the timber on the woodlot (which may be negative if budworm-damage is involved), and the perceived availability of a market. Changes in any of these last four parameters may offset the effects of the postulated long-run increase in demand.

Higher roadside or delivered prices are immediately

apparent to contractors and haulers. If they have assurance that the mills will accept deliveries, they have a strong incentive to intensify efforts to pursuade woodlot owners to harvest. Where competition is vigorous among contractors, and the value of timber on woodlots is stable or rising, stumpage prices would almost certainly rise as well, although not necessarily by the same dollar or percentage amount. However, neither of these assumptions is appropriate for New Brunswick. Because of budworm-damage, significant quantities of woodlot timber are deteriorating in value; hence woodlot owners have been more eager to harvest. At the same time, delivery of wood is controlled by marketing boards (and major firms) through the distribution of delivery "tickets" mainly to contractors. As a result, competition among contractors is sharply restricted. The effect of these arrangements is to shield the haulers and contractors against the market power of the dominant firms, while not protecting timber producers. Under these circumstances, higher delivered prices for woodfibre will cause little increase in stumpage rates until the budworm problem shall have been resolved. And even then, it is unclear whether average stumpage rates will be much -- if at all -- affected.

CHAPTER 4

THE CROWN LANDS AND FORESTS ACT

Introduction

In the early 1970's, increased utilization of New Brunswick forests appeared to be leading toward an elimination of excess supplies and eventual shortfalls. Concerned, the Government commissioned a major study of the Province's forest resources, the Tweeddale Report (N.B. 1974). Its wide-ranging discussion includes the following key passage:

> The practice of assigning public lands to individuals and corporations for the purpose of exploiting the timber resources is probably the simplest and most efficient way of allocating the timber resource so long as that resource is essentially uncultivated and far in excess of needs. That day has passed in New Brunswick. Currently the harvest of several species of wood is at, or close to, the calculated allowable annual cut. The Crown lands belong to the people of New Brunswick and should be exploited and developed to the benefit of the people no less than to that of the wood-using industries. The people of the Province should be paid the full worth for their resources up to a level at which efficient forest

industries, dependent on Crown wood, can prosper.

> We propose that all Crown timber licenses be terminated as soon as feasible. The Government, representing the owners of the public forests, could then allocate any kind of wood from any acre of Crown forest to the most appropriate end-use -- a right seldom surrendered by other owners. Coupled with this change would be government guarantees of sufficient wood to keep plants running at their rated capacities, so long as they make full use of supplies to be had from their own woodlands or from woodlot owners. In effect, the Crown would become the supplier of the residual wood requirements after industry has taken full advantage of all available private sources.
>
> (N.B. 1974, p. 289; emphasis added)

Many of these considerations are embodied in the Crown Lands and Forests Acts (CLFA), passed in 1980 after extended public consideration. Effective 1 April 1982, the CLFA cancelled existing cutting rights, licenses, and leases of Crown lands, replacing this patchwork structure with a consolidated system of Crown timber licenses and sub-licenses. This involved a major reallocation among timber users of the harvest from Crown land, and placed responsibility for silviculture on that land on the new licensees. Under the new system, only ten major industrial users hold Crown timber licenses. Each licensee is contractually obligated to file industrial, management and operating plans with the Crown, and to reach agreements with other, generally smaller, industrial wood-processors (primarily sawmills) as sub-licensees.[34] These plans and agreements are all subject to review and approval by the Crown. In addition, each licensee must undertake similar planning and management activities on timberlands it owns in the Province, and provide various reports. Importantly, the

Act also modifies the setting of stumpage rates for Crown timber.

Clearly, the CLFA primarily addresses the last three problems identified in Chapter 1, serving four specific goals:

- to improve the forest management on Crown and private lands;
- to utilize the woodfibre harvested from Crown and other lands better;
- to maintain the long-run economic health of New Brunswick's wood-processing industry; and
- to increase the Crown's returns from its woodlands.

Given the deliberate evolution of this law, it is understandable that it appears to enjoy strong support from a wide range of industry participants, some of whom describe it as "landmark legislation."

The statute's immediate impact is on the licensees and sub-licensees, whose relationships with one another and with the Crown have been significantly altered. But the law was anticipated to have a major effect on non-industrial private forest holdings (woodlots), too. Specifically, it was expected to stabilize and increase the demand for timber from woodlots by making these holdings the primary rather than the residual source of supply, and by raising Crown stumpage rates. Whether these expectations are likely to be realized is the main question addressed in this chapter.

Primary versus Residual Source of Supply

Does the CLFA interchange the timber supply roles of Crown land and woodlots, putting the latter first? Many informed observers believe that it does, establishing private woodlots as industry's primary source of woodfibre. For example, the Select Committee's Report (N.B. Legislature 1981, p. 5) states:

> The Act stipulates that as of 1 April 1982, the wood supply shall come first from privately-owned acreages, then from large freehold and finally from

crown forests. As the industry must cut first on private woodlots, it is towards the private woodlot owner that forest management initiatives must be specifically directed.

To gauge the likely effects on the demand for woodlot timber of the CLFA's primary sourcing provisions, four issues must be addressed:

- Was the primary supply source Crown land, and the residual source woodlots prior to the CLFA?
- How does the CLFA mandate and control timber supply sourcing?
- What are the meanings of primary and residual supply, and how have these concepts been interpreted by the Government?
- Under what conditions is residual sourcing from Crown land compatible with other CLFA and Provincial goals?

In the period prior to the introduction of the CLFA, given low stumpage rates on Crown lands and the general preference of firms to control their supply sources, industrial wood-processors may have had an incentive to use Crown lands as their primary supply source, obtaining only residual supplies from woodlots.[35] Bearing in mind that the individual circumstances of processing firms differ significantly, nevertheless data in Table 4.1 on timber produced in the Province and consumed in Provincial mills cast doubt on this proposition. In both percentage and absolute terms, in the fiscal years from 1977 through 1981, fluctuations in output on Crown land exceeded those on woodlots and large freeholds. Moreover, exports (only by wood-processors from private lands) were a factor stabilizing production on private land.[36] Furthermore, over this five-year period, output from Crown land relative to growing stock was significantly lower than the Provincial average (1.7% versus 2.1% of softwood inventory). Obviously, these statistics reflect the pre-CLFA

TABLE 4.1
ROUNDWOOD FROM NEW BRUNSWICK
CONSUMED IN PROVINCIAL PULPMILLS AND SAWMILLS
(in cubic metres)

Fiscal Year	Ownership Class	Softwood	Cedar & White Pine	Hardwood
1982	Crown	2,186,577	113,674	267,370
	Own & Large Freehold	1,452,275	49,998	272,011
	Small Freehold	1,601,629	100,731	373,178
	TOTAL	5,240,482	264,408	912,559
	Imports	585,548	19,116	57,015
	Exports	226,749	3,859	278,631
1981	Crown	3,152,809	148,821	426,204
	Own & Large Freehold	1,719,931	48,682	405,102
	Small Freehold	2,046,174	108,427	497,882
	TOTAL	6,918,915	305,931	1,329,190
	Imports	714,713	20,056	89,067
	Exports	285,812	4,270	251,909
1980	Crown	3,756,682	173,822	445,788
	Own & Large Freehold	1,562,467	52,210	382,582
	Small Freehold	1,988,383	96,209	500,456
	TOTAL	7,307,532	322,242	1,328,828
	Imports	608,666	18,782	176,541
	Exports	407,187	10,199	254,434
1979	Crown	3,430,651	154,159	530,452
	Own & Large Freehold	1,749,080	49,987	413,351
	Small Freehold	1,578,488	64,146	449,220
	TOTAL	6,758,220	268,293	1,393,025
	Imports	848,620	12,170	174,179
	Exports	570,178	12,125	191,625
1978	Crown	2,909,259	188,320	327,684
	Own & Large Freehold	1,465,802	38,782	381,359
	Small Freehold	1,775,409	71,004	332,136
	TOTAL	6,150,471	298,096	1,041,180
	Imports	881,521	14,894	95,223
	Exports	385,097	9,483	122,458
1977	Crown	2,640,473	114,708	314,962
	Own & Large Freehold	1,468,092	33,433	318,493
	Small Freehold	2,017,818	49,871	304,864
	TOTAL	6,126,384	200,845	938,319
	Imports	764,213	13,076	53,881
	Exports	415,566	20,832	112,678

Source: NB, DNR-FUB "Timber Utilization Surveys", 1977-1982.

Softwood excludes cedar and white pine.
"Own" includes lands classified as "Large" and as "Small" freeholds.
Exports and imports relate exclusively to New Brunswick pulpmills and sawmills.

distribution of Crown licenses and cutting rights, as well as behaviour in anticipation of the new law. But that is immaterial to the immediate issue: whether before the CLFA, timber demand favoured Crown supply at the expense of woodlots. Were this presumption generally incorrect, then the potential of creating more favourable conditions for woodlot timber output under the CLFA would be correspondingly more limited.

Only two clauses of the CLFA deal directly with primary sourcing:

> 3(2) The Minister shall encourage the management of private forest lands as the primary source of timber for wood-processing facilities in the Province ...
>
> 29(5) An operating plan shall, for a five-year period,
> (a) identify in the following order of priority, proportions of wood supply to be used in any wood-processing facility of the licensee or any sub-licensee
> (i) from Producer Associations in the Province,
> (ii) from freehold lands owned or controlled by the licensee,
> (iii) from other sources within and without the Province,
> (iv) through exchanges of wood or wood products,
> (v) from Crown Lands ...

Close examination of these provisions reveals no explicit requirement for a change in the sourcing of timber for industrial wood-users. Although paragraph 3(2) does refer to "private forest lands as the primary source," its thrust is to encourage better management of all private woodlands, not to control sourcing. Paragraph 29(5) does refer to an "order of priority", but this is in connection with identifying supply

proportions, not supplying them. Because of differing interpretations, these provisions have generated considerable controversy, leading ultimately to a declaratory statement of policy in mid-1983 by the New Brunswick Minister of Natural Resources (1983). We consider this shortly.

Regardless of the legal or administrative meaning of these clauses, the key mechanisms for controlling the sourcing of wood supply are annual ministerial approvals of updated five-year licensee operating plans under CLFA Paragraph 29(7), and allocation of the annual allowable cut on Crown land. As noted in the previous chapter, this approval and consequent access to cutting on Crown land depends on agreement having been reached with marketing boards for the priority supply from woodlots. To understand this interaction between Crown and woodlot timber supply, the process of allocating the Crown timber harvest must be outlined.

The initial Crown harvest allocation among licensees and sub-licensees under the CLFA was based on residual industrial requirements after deducting from the total requirements at full-capacity operation of each firm its so-called primary supply. This is comprised of the annual allowable cuts from the firm's own forest holdings and from woodlots in its area, plus imports and available wood-chips. No woodlot-sourced timber was assumed to be withheld from the market or exported. Sub-licensees received Crown harvest allocations equal to 100% of their calculated residual requirements, licensees got only 71.6%; however the latter enjoy access each year to any unused allocations of their sub-licensees. Although the entire AAC from woodlots was first taken into consideration in the process of distributing the Crown harvest, Provincial timber resources are fully exploited under this allocation; hence, no genuine problem of sourcing priority is involved. Instead, a theoretical supply shortfall is distributed among licensees. The likelihood of this shortfall and the supply priority accorded to marketing boards for woodlots are both strengthened

by the assumption that all owners of non-industrial forest lands are willing to supply timber to Provincial wood-processors. At five-year intervals, depending on performance, future re-divisions of the Crown harvest among wood-processing firms may be carried out, without necessarily changing license boundaries.[37]

The initial allocation of the timber harvest from Crown land assumes full-capacity operation of wood-processors, something which is not sustainable but reflects the utmost limit of past experience, plus an allowance for expansion of processing capacity. Under realistic conditions of fluctuating output levels below capacity, where less than the total Provincial AAC is being cut, "primary" and "residual" supply might be variously interpreted. For example, at low output levels, a larger proportion of potential supply might be purchased from the primary source; or alternatively, the primary source might be paid a higher or a more stable unit price. The difference between primary and residual sources of supply would thus be some combination of greater stability and higher relative timber output, prices or incomes.

It is the declared view of the New Brunswick Minister of Natural Resources (1983) that when timber demand fluctuates below the full-capacity level, the ratio of woodlot supply to the total requirements derived in the initial allocation exercise for each wood-processing firm should be held constant. In other words, establishing woodlots as the primary source of supply has been deemed to mean that cutbacks in their supply should be in proportion to any shortfall in demand below the (unsustainable) full-capacity level. Because the point of reference is to full-capacity demand, this policy declaration imposes somewhat greater output fluctuations (in percentage terms) on woodlot than on Crown timber supply. After majority, minority, and background reports from the Crown Lands and Forests Advisory Board to the Minister (N.B., CLFAB 1983a,b,& c), the official interpretation of "primary sourcing" thus

combines a relatively high base level of woodlot supply relative to growing stock with above-average fluctuations in response to variations in total timber demand.[38] If this official interpretation of primary sourcing is assessed in relation to the pre-CLFA situation -- which was not unfavourable to woodlots -- neither a significant increase in demand nor a reduction in instability of demand for woodlot timber appears likely.

However, for several reasons, this may not be an undesirable outcome. First, there is some short-run potential inconsistency between managing Crown lands on a sustained yield basis and designating them as a truly residual, i.e., variable, supply source. Demand for processed wood products fluctuates, and these variations will disproportionately bear on the residual supply source whenever less than the total available Provincial timber supply is absorbed. The intention to utilize Crown lands fully on a sustained yield basis is embodied in the standard form of forest management agreement (FMA) between Crown and Licensee under the CLFA, as well as in the Forest Management Manual referred to in FMA Paragraphs 1 and 7. To achieve sustained yield and to prevent hoarding by individual licensees, the FMA limits interannual fluctuations in the harvesting of Crown timber:

> 12(2) The Minister agrees that the Company, as a Crown Timber Licensee, may harvest up to ten percent (10%) above or below its allowable annual allocation of timber on the License in any one year during the first five year period of this Agreement, but the total volume of timber harvested during the first five years, shall be within five percent (5%) of the five year aggregate of the allowable annual allocation.

Given the instability in woodfibre demand by New Brunswick's wood-processing industry, this constraint on the annual and

quinquennial cuts on Crown Lands is bound to conflict with the desire to stabilize output from the primary supply source whenever demand falls below Provincial AAC.[39] There is no easy solution to this problem, since overcoming it would imply implementing far-reaching and costly measures to stabilize the marketing of wood products (e.g., lumber, pulp, plywood) within similar bounds and controlling timber exports and imports.[40]

Second, a concern with levels and stability of incomes of persons in rural areas is in conflict with utilizing woodlots as the primary source of supply. Woodlot owners are at least as affluent as the average rural New Brunswicker. Their average income was $19,000 to $20,000 in 1981 (Roy 1983), compared with about $18,800 for the average rural dweller.[41] According to the same survey, only 3.7% of woodlot owners rely on their woodlots for as much as a quarter of their incomes; excluding those with more than 1000 acres reduces the percentage to 3.4%. If the brunt of logging reductions in depressed times is to be borne by Crown lands, this will mean larger layoffs of employees and contracted labour of licensees, a group whose incomes averaged only $16,000 in 1980.[42] A policy that maintains the incomes of woodlot owners, many of whom do their own harvesting, and few of whom depend on their woodlot as even a minor source of income, will harm rural wage-earners, who, as a group, appear to be somewhat less well-off.[43]

Third, if making woodlots the primary source of supply implies that wood-processors generally will have to pay significantly more for their timber supplies, this will reduce their ability to compete on product markets. As observed in Chapter 1, some of the Province's wood-processing plants are marginal factors in export markets on which they are nonetheless dependent; loss of competitiveness may lead to reduced output levels. A too "successful" policy to benefit woodlot owners and secure the full value for use of Crown timber could injure the Provincial economy by pricing New-Brunswick's wood-processing firms out of the market.

A fourth problem affecting the establishment of private woodlots as the primary source of woodfibre to meet industrial requirements proved significant in some parts of New Brunswick in 1982. This is the potential mismatch between woodlot resources and the differentiated industrial demands for woodfibre. Timber harvesting by partial or total clearcutting of most woodlands generates a variety of products, since most mature forests contain a mixture of species and sizes. In each of New Brunswick's five resource areas, woodlots contain a higher proportion of hardwood and a lower proportion of sawlog-sized softwood than Crown land. They also have a higher proportion of budworm-damaged fir and spruce. When the demand is relatively strong for construction lumber and weak for pulp, excess pulpwood will be cut if the primary supply source is the woodlot. Industry is understandably reluctant to accumulate excess pulpwood inventories in times of soft markets. Furthermore, although harvested wood can be stored for some time before pulping without severe loss of quality, budworm-damaged wood will deteriorate more rapidly. Essentially, this is a problem of the varying quality of the forest resource, combined with clearcutting rather than selection cutting; it is particularly important in southern New Brunswick, where the proportion of woodlots is highest and budworm damage worst.[44] A long-term approach to a solution might involve less clearcutting and more uneven-aged forest regulation on the Province's woodlot resource.

Stumpage Prices on Crown Land

Under the CLFA, stumpage rates on Crown land are to "be based on the fair market value of standing timber" by class:

> 57 Timber on Crown Lands shall be classed by species or groups of species as veneer logs, saw logs, pulpwood, poles, fuel wood, Christmas trees and other such classes as may be prescribed by regulation.

> 59(1) The royalty for each class shall be based on the fair market value of standing timber of that class, as determined by the Lieutenant-Governor in Council and shall be prescribed by regulation.

"Based on" is not synonymous with "equal to"; nor is "fair market value of standing timber" the same as the amount the standing timber on Crown land would bring on being cut, if it were sold at auction under competitive conditions. Stumpage values vary greatly with accessibility, topography, distance to a processing plant, quality of timber, volume per acre, season of year, and conditions of sale. Furthermore, there is a practical problem of determining fair values when only an eighth to a sixteenth of all timber harvested in the Province is marketed as standing timber on a unit price by species basis.[45] Presumably Paragraph 59(1) means that Crown stumpage royalties should relate in a reasonable and transparent manner to market values of standing timber actually being sold.

In 1981-82 before the implementation of the CLFA, Crown stumpage rates ranged from $1.50 and $2.15 per cubic metre for hardwood and softwood pulpwood, to $2.40 and $3.20 per cubic metre for hardwood sawlogs and veneer logs. As Table 4.2 makes clear, these values were substantially higher than those from 1962 to 1976. Increases from fiscal 1981 to fiscal 1982, the first year under the CLFA, were significant.

How do these Crown timber royalty levels compare with stumpage rates on private sales? Woodlot Service (1982a), on the basis of a rapid survey, found private stumpage rates for softwood pulpwood in New Brunswick in 1981 ranging from $6 to $25 per cord with an average (modal value) of $10.20 ($4.23/cubic metre). Logs were found to vary from $20 to $70 per Mfbm with an average of about $40 ($7.10/cubic metre). Substantial intra-Provincial variations were noted for these as well as for other forest products. In 1982, prices and price variations were found to be approximately the same, except for

hardwood fuelwood and pulpwood, which had gone up 40% to 80% in value.[46] Since there is no systematic collection of data on these rates, these informed judgements are the best information available. Other sources (e.g., Runyon 1983) suggest prices consistent with these values.

TABLE 4.2

PAST CROWN ROYALTY RATES
(per cubic metre)

Timber Class		Rates 1962-76	Average Annual Increase 76-81	Rates 1981-2	Increase to 1982-3
Softwood	Pulpwood	$1.34	10%	$2.15	37%
	Sawlogs	.88-1.06	19%*	2.40	38%
Hardwood	Pulpwood	.50	25%	1.50	26%
	Sawlogs	.53-1.06	23%*	2.50	20%

* : based on average value in 1976.
Sources: N.B., Task Force on Forest Management (1981).
N.B., CLFA Regulations 82-43 & 82-48.

Crown stumpage royalty rates for fiscal 1982 were fixed by Regulations 82-43 and 82-48 under the CLFA at the levels shown in Table 4.3. Despite large increases in royalty rates from the previous year, most rates were still well below the Crown's estimates of fair market values. This reflects Government reluctance to raise Crown royalties excessively during an economic downturn as well as basic differences between Crown and private land:

- Crown stumpage rates relate equally to all Crown land, while private stumpage rates are fundamentally a residual which varies with the ease of access and other characteristics of the private lot being harvested.
- Crown stumpage is, on average, twice as far from processing plants as private stumpage.
- Costs of accessing Crown stumpage from public highways are generally substantially higher than for woodlot stumpage, since licensees must build roads at costs ranging from $1 to

$2 per cubic metre cut.

- Harvesting and utilization of Crown stumpage must meet CLFA standards, unlike harvesting on woodlots.
- Licensees, unlike woodlot owners, must meet the planning, accounting, operating and reporting requirements of the CLFA.

The last four of these factors force the stumpage rates on Crown land downwards relative to woodlots, while the first complicates any easy comparison. The negotiated overhead charges levied on sub-licensees by licensees (in addition to the Crown stumpage charge) approximates the last three of these items. These charges ranged in 1982 from $1.90 to over $5.00 per cubic metre for softwood sawlogs.[47] An unpublished DNR study of delivered costs of such sawlogs in 1982 indicated that

TABLE 4.3

NEW BRUNSWICK CROWN ROYALTY (STUMPAGE) RATES (FISCAL 1982-83)

Class of Timber	Fair Market Value	Rate	Royalty
Softwood veneer logs	$ 8.30/m^3	50%	$ 4.15
Hardwood veneer logs	$10.00/$m^3$	50%	$ 5.00
Softwood[1] sawlogs	$ 6.60/m^3	50%	$ 3.30
Hardwood[2] sawlogs	$ 5.00/m^3	60%	$ 3.00
Poles & Pilings	$13.00/$m^3$	80%	$10.40
White Birch-Spoolwood	$10.60	50%	$ 5.30
Softwood-Studwood	$ 5.50	50%	$ 2.75
Cedar Pulpwood	$ 2.50	80%	$ 2.00
Softwood Pulpwood[3]	$ 4.20	70%	$ 2.94
Hardwood pulp & fuelwood	$ 2.10/m^3	90%	$ 1.89
Top poles	$ .30/piece	80%	$ .24
Weir brush	$ .03/piece	100%	$ .03

1. includes sugar maple and yellow birch
2. excludes species in note 1 and poplar (valued 10% lower)
3. excluding cedar

Source: N.B. 1982. Regulation 82-48 under the CLFA.

those bought from private lands cost 13% less than those from Crown land on average. Despite this evidence that "the people of the Province [are now] being paid the full worth for their resources" as recommended by the Tweeddale Report, it is nevertheless still widely felt in the Province that Crown licensees have an incentive to cut from Crown land rather than buy from woodlot owners.

Basing Crown stumpage rates on market values of private stumpage sales involves an element of circular causation. Fair market stumpage rates on private non-industrial lands are not independent of the rates on Crown land. If the latter are low, licensees have an incentive to restrict purchases from woodlots to the minimum required and to expand purchases from the Crown up to the maximum permitted (although, as we have seen above, these constraints are relatively rigid). This will tend to give the licensees greater leverage in negotiations. If Crown stumpage rates are high, the opposite situation prevails. Thus, changes in Crown stumpage rates influence the delivered prices and likely the fair market values of woodlot stumpage, on which they in turn are supposed to be based. This causal ring is further complicated by the first factor mentioned above: that Crown stumpage rates are average rates applicable equally to all Crown lands, while private rates vary with woodlot accessibility and quality.

As pointed out in the previous chapter, stumpage rates on particular forest sites are demand determined. They are residuals, "pure economic rents," which vary with site quality, accessibility, and distance to processing facilities. But Crown stumpage rates are fixed unit charges which do not vary with the quantity of timber produced or the quality and accessibility of Crown land harvested. Expressed differently, the cost to a licensee of securing an additional cord from Crown land does not affect the costs of cords already produced, while all woodlot deliveries (from a given district) receive the same unit delivered price -- a price which is sensitive to

the quantity bought (c.f., Lowry & Winfrey 1974) . Therefore, increasing woodlot purchases by an incremental cord raises the licensee's costs by the amount paid for the incremental cord plus the additional amount which now must be paid for all other cords purchased. In other words, economic rents on the accessibility of woodlots are captured by the sellers, not the licensee; while variations in economic rents on the accessibility of Crown land accrue to the licensee, not the Crown.

On a perfectly competitive and transparent market for woodlot stumpage, the economic rents on woodlot accessibility would flow to woodlot owners, not contractors. But the actual marketing situation, as we saw in the previous chapter, involves monopsony power and negotiated delivery prices. Under these conditions, a rise in timber quantity delivered from woodlots may reduce average private stumpage rates because the average accessibility and quality of harvested woodlots declines as more are harvested in any period.

Conclusion

In Chapter 3, the link between delivered and stumpage timber prices was examined under the institutional circumstances prevailing in New Brunswick. This chapter has focused on the anticipated influence of the Crown Lands and Forests Act on the industrial demand for timber from woodlots. Two mechanisms, it was thought, would lead to higher negotiated prices for deliveries from these non-industrial holdings:

1. the establishment of woodlots as the primary source of industrial wood, and
2. increases in Crown stumpage rates.

With respect to sourcing, there is some question whether woodlots were the residual and Crown lands the primary supply source before the CLFA. It was also noted that the official interpretation of "primary supply source" sets the base level of demand for woodlot timber at a generous level, while

appearing to share proportionately among the various sources of supply. Since this proportionality is related to full-capacity operation which cannot be sustained, somewhat disproportionate variations in guaranteed woodlot sourcing are implied in practice. In addition, other goals sought by the legislation and the Government are incompatible with excessive emphasis on primary sourcing from woodlots. Hence, although it may somewhat increase the share of woodfibre being drawn from woodlots, this aspect of the CLFA can be expected to have at most a modest effect on delivered timber prices..

The second mechanism is more promising. Certainly, Crown stumpage rates have been sharply increased under the CLFA. However, taken in conjunction with marketing board arrangements, neither the dependency between delivered woodlot timber prices and licensee costs of securing Crown timber, nor the link between Crown timber royalty rates and private stumpage rates is straight-forward.

Viewed together, this chapter and its predecessor question whether current Provincial policy as embodied in marketing board legislation and in the CLFA will much increase stumpage returns to woodlot owners. In fact, the limited data on trends in private stumpage rates in New Brunswick indicate an increase less rapid than inflation; in other words, in recent years, "real" stumpage returns have fallen. In the next chapter, doubts regarding rising stumpage rates are put aside, and analysis centres on the relationship between stumpage rates and management intensity: whether higher current stumpage rates will lead woodlot owners to invest more in managing their forest properties to produce larger amounts of timber for future delivery.

CHAPTER 5

INVESTING IN THE MANAGEMENT OF SMALL PRIVATE TIMBERLANDS

Introduction

In the silvicultural community, few issues have attracted more attention and debate than the forestry practices of small woodlot owners. Sedjo and Ostermeier (1978, p.44) suggested that a complete listing of recent materials "would contain over 300 citations." This is surely a gross underestimate. Fifteen years earlier, McMahon (1964) had already listed 140 English-language references. And there is a substantial Germanic and Scandinavian literature extending back to the turn of the century. In the last five years, there have been conferences (e.g., NASF and USDA - FS 1980; Howlett 1982; and Lortie and Lamontagne 1982), position papers (e.g., USDA 1978; SAF 1979; NFPA 1980), theses (e.g., Murphy 1981; and Ewing 1981), international workshops (e.g., Järvelainen 1981), monographs (e.g., Clawson 1979; and Binkley 1981), bibliographies (e.g., Kurtz and Crouse 1981), review articles (e.g., Glascock 1981), and a flood of journal articles.

Whether forest management practices of woodlot owners are significantly less intensive than those of industrial owners and governments on their woodland holdings is one disputed issue. In the United States, the small forest property has

been regarded as the crux of the timber-management problem for decades in official U.S. Forest Service publications (1933, 1946, 1958, 1973, 1976, 1978). Similar concerns have been expressed in Scandinavia (Stjernquist 1973; Lönnstedt 1981). In Canada, "it is also generally held that they [private forest lands] are not producing at anything like their potential and that management is poor to non-existent" (MacArthur 1979). However, Clawson (1979), Binkley (1981) and Hyde (1981) have recently renewed the generation-old challenges of Duerr, Vaux and Stoddard (1954) and McMahon (1964) to the conventional wisdom. Further north, LeBlanc (1982) has sharply criticized the quality of past forest management by both industry and Crown.

Another contentious question is the potential contribution of improved management on small woodlots to expanded future timber supply. At least part of the silvicultural establishment in North America (e.g., Place 1978, p. 560; USDA 1978) anticipates future timber shortages and has targeted smallholdings for improvement. Similar, but more immediate, concerns prevail in Scandinavia (Zivnuska 1959; Järvelainen 1981), where the capacity of the wood-processing sector has expanded beyond the region's AAC (Randers and Høsteland 1979).[48] Since a "shortfall" or "shortage" implies a market disequilibrium, where supplies are less than demands at some assumed price level, higher prices will presumably eliminate it, although possibly with some lag (Field 1982c; Binkley 1981, p. 27). Taking prices into account, Sedjo (1982), Manthy (1978), and Raup (1978) have expressed doubts regarding a future woodfibre shortfall in North America. Others (e.g., Zivnuska 1978; Sedjo and Ostermeier 1978; Glascock 1981; and Irland 1981) have pointed out that growth exceeds harvest on this continent's non-industrial timberlands; hence a biological -- and possibly economic -- current surplus is apparent.

Clearly, if neither current nor future markets require additional supplies from woodlots, public efforts to induce

improved management practices directed toward timber production are misdirected (Baskerville 1977).[49] If, on the other hand, these supplies are needed, it is not clear whether they will be forthcoming. For example, McMahon (1964), Popovich (1978), Clawson (1979), Glascock (1981), and Irland (1982d) have questioned whether improvements in woodlot management would be likely to resolve even a hypothetical woodfibre shortage. Related to this last issue is the primary concern of this chapter: whether greater real returns to woodlot owners from harvesting lead to more intensive forest management on their holdings, and hence growth of more timber for future harvests.[50]

In considering this question, bear in mind that management activities may be directed toward different futures, that the challenges facing forest policy in New Brunswick have differing time-dimensions, and that anticipations of timber markets at future times may diverge. For example, management options to deal with the medium-term softwood timber shortage projected for New Brunswick are limited to stand improvement (thinning, spacing, hardwood suppression), protection and fertilization, but markets for deliveries during the period in question are likely to be strong. On the other hand, improvement of species, site and genotypes, and the acceleration of establishment of forest stands will result in increased timber harvests only in the long run when a buyers' market for timber may have reestablished itself as supplies outstrip demands after 2020.

Forest management is in essence an investment activity in which current resources are expended and costs incurred in the anticipation of realizing a larger future benefit. Forestry is unusual, however, in that harvesting, i.e., realization of production, competes with investment; invested capital in growing trees is simultaneously potentially harvestable output. Investment theory tells us that two necessary conditions -- neither of which alone is sufficient -- must be met before an

investment is undertaken by an economically-motivated owner. First, a supply of resources to invest must be available to the owner: time, manpower, know-how, equipment, credit, cash; second, a particular investment must "demand" these resources because anticipated rewards in that use outweigh alternatives, taking into account the uncertainty of future events (c.f., Field 1977).

Four questions must be answered to apply investment theory to non-industrial forestry:

1. How compatible are the characteristics of woodlot owners with growing timber for harvest (c.f., Worrell and Irland 1975) and how available are investment resources for forest management activities? Goals of owners vary; only a minority may view their forest from an economic perspective, while others carry out management activities because of an "environmental ethic" (Field 1977). A few are unwilling to harvest for aesthetic reasons. Some lack resources, entrepreneurial impetus, and knowledge of the possibilities. Furthermore, ownership may change within a tree crop rotation. For investment over and above natural growth to occur, owners must not only want to invest, they must be able to secure financing, rely on silvicultural research, get timely delivery of nursery stock, call on extension services, hire trained and equipped woodsmen, and supervise contractors and crews.
2. How profitable are investments in growing timber, and how economically attractive are woodlot management practices, given alternative investment possibilities? An adequate answer should consider the effectiveness of forest management inputs in increasing forestry outputs, the costs of those inputs, and the anticipated prices of outputs.
3. How does the scale of woodlots and their non-industrial nature affect investment decisions in comparison to industrial timber operations? One cannot assume that

woodlots will replicate silvicultural effectiveness on industrial woodlands. Nor are markets for inputs and outputs likely to be the same: not only different silvicultural methods but different harvesting techniques and use of equipment may be implied. Furthermore, the decisions of non-industrial owners are likely to be more subject to short-term influences.

4. In light of the answers to the previous questions and the long-term nature of most investments in forestry, what are the relationships between changes in current stumpage prices and decisions to harvest and manage woodlots for timber production? This clearly will relate inter alia to expectations of future stumpage prices.

Woodland Management: Resource Availability and Ownership Goals

There is remarkably little systematic knowledge regarding the resources directly controlled by woodlot owners and their access to borrowable, purchasable, or requestable external resources for timberlot management (Gray 1978; Royer and Convery 1981). For example, Glascock's review (1981) repeatedly refers to data gaps. Even scarcer is information specific to New Brunswick. The Province's non-industrial forest owners appear to be older and better educated than the average adult population (not necessarily those owning real estate, however), and to have modest incomes (Roy 1983). The overwhelming majority live on or within 25 miles of their woodland, on which they do not depend for a significant portion of their income. Farmers have long ceased to comprise the majority; blue and white-collar workers and retirees have become increasingly important. Like their counterparts elsewhere, a substantial portion are ill-informed regarding forest management, being unaware of sources of information and assistance. Only half have had some training in logging (c.f., Glascock 1981; Larson 1980; and Sedjo and Ostermeier 1978).

Unfortunately, this reveals little about ownership or availability of resources which could be invested in forest

management. In what measure broad judgements, such as those of Stoddard (1961) about the unavailability of capital and credit (Popovich 1978; NFPA 1980), the lack of managerial and other skills, the shortage of time (Field 1977, p. 6) and equipment (Clawson 1979, p. 255), the difficulty of hiring equipment and trained workers (USDA 1978, pp. v-vi), and the non-insurability (Sedjo and Ostermeier 1978, p. 25) of woodlot capital, apply to New Brunswick has yet to be investigated. Despite recent improvements in extension efforts by government and marketing boards, there is evidence that woodlot owners are less well served by forestry professionals than owners in adjacent areas or industrial owners (LeBlanc 1982 p. 6).[51] For example, most large wood processors in New England have landowner assistance programmes, which are almost totally lacking in New Brunswick.[52] Of those owners using extension services, three-quarters were satisfied; however, only half found the services of logging contractors satisfactory (Roy 1983, Table 32). Data are not available which would enable these general concerns regarding availability of investment inputs to woodlot owners to be made more precise.

With respect to the goals of owners, we are somewhat better informed. Surveys of non-industrial owners of woodlands consistently reveal few owners who regard commercial timber production as the primary reason for ownership.[53] In Nova Scotia (MacQuarrie 1981, p. 42), this was the primary motive for 8.7%, in southern Ontario (Smyth and Nausedas 1982, p. 42) for 2.5%, in New Hampshire (Kingsley 1982, p. 25) for 4%, and in New Brunswick (Roy 1983, Table 5) for only 4.5%. A further two to four percent are primarily motivated by Christmas tree and maple syrup (butter, sugar, etc.) production.[54] Despite these low percentages, 28% of the owners (holding 47% of the area) had sold forest products in the last two years in Nova Scotia, and a further 22% had apparently harvested for their own use (MacQuarrie 1981, p. 42). In southern Ontario, 29% had sold forest products and a further 28% had harvested since

acquiring the land (Smyth and Nausedas 1982, p. 69). In New Hampshire and Vermont, 24% of the owners holding nearly two-thirds of the commercial forest land had harvested timber (Kingsley 1982, p. 25). Roy (1983, Table 58-1) found 38% selling forest products and a further 23% of owners harvesting for their own use in New Brunswick. Furthermore, few of those not harvesting are opposed in principle: 4% in southern Ontario (and a further 5%, who find cutting incompatible with the primary use), 10% in Nova Scotia, "few" in Vermont and New Hampshire (Smyth and Nausedas 1982; Kingsley 1982; and MacQuarrie 1981). In New Brunswick, three-quarters of owners surveyed intend to harvest in the future (Roy 1983, Table 58-2).

On the other hand, these same surveys indicate that few owners engage in forest management; those who do often are taking advantage of various cost-sharing subsidy programmes. The most significant management activities are boundary maintenance and road-building, neither of which contributes directly to future timber outputs.[55] This attitude toward forest management is scarcely surprising if timber production is a by-product of holding forest land for quite other purposes. A number of authors (e.g., Glascock 1981; Trokey and Kurtz 1982; Field 1977; Binkley 1981; Clawson 1979, pp. 250-260) have reviewed the behaviour of small woodland owners and reached similar conclusions, perhaps most succinctly formulated by Kingsley (1982, pp 25-26):

> it is clear that nonindustrial private owners are not opposed to harvesting timber. It would appear that nearly all nonindustrial private forest land is available for harvesting timber at some time, at some price, and in a way that is consistent with the landowner's wants and desires. What owners don't seem to be interested in, or perhaps don't really know about, is management.... Timber production is of secondary or even lower importance to the

majority....

Thus, even when the primary goal of owning woodland is not timber-production but aesthetic pleasure, hunting or recreation, markets for stumpage may nevertheless importantly influence owners' decisions to harvest and modestly affect other management decisions as well (Vardaman 1978; Binkley 1981, p. 77).

Returns to Timber Growing and Forest Management

Highly divergent views prevail regarding the profitability of forestry. In part, this is a reflection of vastly different conditions in various parts of the world. Unfortunately, information regarding the economic rewards to timber growing in the spruce-fir forests of eastern Canada is not immediately available in a usable form. There are several approaches to examining this question: least helpful are general statements regarding forestry and private non-industrial woodlands. Second, there is a modest body of research which contains yield curves for northern conifers and hardwoods utilized as in New Brunswick. In a few cases, the costs of achieving these yields through various management techniques have been set against the value of the yields and an economic analysis has been carried out. Roughly thirty published studies of this type are considered in detail in Appendix III of Huber (1983), and the results summarized below. A third approach is through economic case studies of forest practices by non-industrial owners in eastern Canada and northern New England. Finally, there may be relevant anecdotal evidence from industry participants in the Maritimes and northern Maine.

America Grows on Trees (NFPA 1980), a recent industry publication, is an example of the first type. It claims that forest management on 7.5 million acres of non-industrial private land in the northeastern region of the United States offers "timber-growing opportunities producing an incremental rate of return of at least 10% after tax" (Appendix A, page

49). A million of these acres involve intensified management of softwoods. This study does not indicate how its calculations have been carried out, but it does recite (p. 9) the customary litany of "special problems to potential investors" in forestry:

> long time lags between the initial investment and the financial returns from it,... lack of technical knowledge necessary to successfully make and manage a forestry investment; difficulty in finding equipment and manpower for forest management work, especially on small ownerships; relatively high unit costs of management and market disadvantages on small-sized ownerships; lack of adequate markets in some areas; perceived conflicts between timber production and other ownership goals, and uncertainty over future government actions....

Cook (1978) suggests (nominal?) rates of return ranging up to 12%. Mills and Cain's (1978) 10.2% estimate of the real pre-tax rate of return to Forestry Improvement Program management activities in the U.S.A. may be the basis of some of these judgements. However, despite assumptions which bias their results upwards, these authors obtained only 6.7% for planting spruce and 3% for spruce/fir timber stand improvement (TSI), managed in both cases for sawlog utilization.[56] Foster (1982, p. 706) regards "low rates of return, high risks, long pay-back periods, and high initial capital requirements ... [as] bogeymen." He cites pre-tax rates of return of 12.4% per annum in southern pine, but admits that these values require downward adjustment for inflation to a real rate of return of 4%. Clawson (1979) also suggests prevalence of high rates of return, although two years earlier (1977, p. 51) he found that

> purchase of ... land at market prices and managing it for wood production do not offer very good prospects

> for as high a return on capital as might be earned elsewhere.... If forest land will be owned irrespective of income,... the outlook is a good deal better.... Economic timber management under these conditions often means harvesting fairly frequently and to levels of stocking which the professional forester regards as undesirable.

Again, the U.S. Department of Agriculture's publication (1978, p. 30) admitted that "the pre-tax yield on capital invested on forest land management averages 2.5% to 3.5% nationwide,... In addition [there is] the lack of insurance."[57] Stoddard (1961) suggested pretax nominal rates of return to pulpwood production of 5.2% and 3.2% in the U.S. Northeast and Lake States, and compares these to returns of 5.6% on common stock and 3.1% on corporate bonds, both of which provide incomparably greater liquidity and involve less risk. Even without the confusion caused by frequent failure to adjust for general inflation, a prospective investor in forest management must be rather disconcerted by this diversity of presumably informed opinion.

Empirical evidence on the yield of northern conifers and rates of return to various forest management practices under climate and market conditions similar or identical to those in New Brunswick is not encouraging (Huber 1983). To begin with, at current stumpage rates discounted at five percent real return, the value of average quality bare land for growing pulpwood in New Brunswick will equal $18 to $30 per acre before deduction for capitalized property taxes of $7.50 per acre. Hence, if such land sells for more than $22 per acre, the real rate of return is correspondingly lower. For example, at $100 per acre for land alone, the real return after property taxes (but before income tax) without management is about 2.5%. A similar result has been obtained by Runyon (1983, p. 11). Site preparation and planting of fast-growing softwoods on good sites with optimal spacing and management for sawlogs can under favourable conditions apparently produce real returns of as

much as 8% per annum on the management activity. Planting and management for pulpwood yields about half as much. Hardwood thinning and management, with a view to sawlog and veneer log production can also produce high real returns. Virtually all other management options appear to yield real returns less than 5% per annum under favorable circumstances in eastern Canada. Less felicitous conditions lead in most cases to negative returns. In most cases, these returns were achieved with the advice and assistance of silvicultural professionals, so they may be regarded as representing an upper limit. Given uncertain markets, risk of loss, and the professional knowledge required in pursuing forest management, the technical literature on northern conifer yields fails to justify investment by private interests in forest management to produce pulpwood at current stumpage rates in New Brunswick (c.f. Runyon 1983, pp. 11-12).

The most detailed published reports on actual woodlot operations are those by Barraclough and Gould (1961). In summarizing their findings regarding operations in northern New England (p. 135) they found,

> that a high intensity level of [forest management] eventually would lead to sales at a level of about two and a half times as high as that maintained under a low intensity. Under medium intensity, sales eventually could be maintained about 50% higher than under low intensity. These higher productivity rates, however, would not be reached until after about forty years.... Despite greater yields it would not under all circumstances pay these owners to adopt high intensity forest management. Before this kind of management is feasible there have to be markets for all sorts of forest products including the low-grade timber that often results from thinnings and improvement cuttings. The long-term market and price outlook for high-quality timber must

> also be favourable before most owners will seriously consider adopting long range plans for intensive management. In addition, adequate woods labour must be available locally or on the farm, and forest taxes should not be too burdensome.

The anecdotal evidence is not inconsistent with this picture. The consensus is that forest management (of unspecified sorts) will double future output, but that the immediate (and ongoing?) costs of most activities are high. Returns to forest management are perceived as low, long-delayed, and uncertain; industrial owners of forests are thought to operate under more favourable conditions than woodlot owners. For the latter, this implies that the decision to manage often depends on non-economic considerations; for the former, the decision is justified in the context of an overall integrated operation. As an example, the low returns on woodland activities to one of the large industrial firms in the Province were explained with the observation that, "silviculture is a cost of staying in the paper and pulp business."[58]

Non-industrial Nature and Scale of Woodlots

Aside from differences in resource availability and in goals, industrial and non-industrial forest owners in New Brunswick differ in four other ways. By definition, the latter do not own wood-processing facilities. Few are incorporated, hence they have a shorter time-perspective than "immortal" multi-national corporations. Moreover, their holdings are individually far smaller. Finally, for reasons examined in Huber (1983, Ch. 6), budworm damage disproportionately affects woodlot holdings in the Province.

An obvious result of the first of these differences is total dependence of woodlot owners on external markets for sales of timber and other forest products. Experience has shown that in some areas for some grades and species these markets do not exist, or are unreliable or dominated by

contractors or processors (Clawson 1979, ch. 12). Despite the operation of marketing boards, this generalization holds for New Brunswick, too. Often, market information on stumpage prices is unrepresentative or unavailable. These market deficiencies lead woodlot owners to expect lower stumpage prices (possibly zero for some outputs) than would otherwise be the case (Raup 1978). At the same time, the possibility of future sales is perceived as being subject to great uncertainty. Moreover, New Brunswick's long-term timber supply situation, which was outlined in an earlier chapter, does not imply strong markets for woodlot pulpwood after 2020.

It is often asserted that tenure of woodlot owners is short. However, a high proportion inherit some or all of their holdings, which may have been many years in the family. Nevertheless, long-term tenures are not necessarily inconsistent with short-term attitudes toward the growing forest. For example, harvest decisions of some woodlot owners appear to be triggered by family cash crises and hence unresponsive to market and silvicultural imperatives. In effect, the woodlot is a savings account for these owners.[59] Such attitudes make quite understandable a reluctance to become committed to long-term forest management, and they seriously undermine the potential benefits from silvicultural activities. Since anticipated output increases from specific management practices frequently depend upon further silvicultural treatments, and cannot be realized at all if the land is removed from timber production (Irland 1982c, p. 15), the retention of silviculturally treated woodlots under management is a key concern (Field 1982c, p. 58). An example of the significance of this is provided by Kurtz, Alig and Mills (1980), who examined cost-shared (ACP) conifer plantations in five central U.S. states ten to fifteen years after establishment: only 41% required no immediate attention, a like percentage needed silvicultural work, and the remainder either did not warrant retention or had been removed from

timber production.[60]

The extent to which the empirical evidence on rates of return to northern conifer forest management examined in Huber (1983) match typical woodlot scale varies, and the extent of adjustment to their results required to overcome mismatching is unknown. In New Brunswick, two-thirds of the woodlots, with one-third of the aggregate woodlot acreage, contain less than 100 acres. The conventional wisdom (Stoddard 1961; Sedjo and Ostermeier 1978, p. 26; USDA 1978, p. v.; and Larson 1980) holds that significant diseconomies of scale affect small forest holdings. Popovich (1978 p. 229), for example, claims that "less than 100 acres [is] too small to have serious commercial potential." Clark Row (1978) is one of the few to have addressed the question of scale economies in forestry empirically. He concluded that the effect of scale is more important on poor than on good sites, that strong effects prevail on holdings under 50 acres, but that even at 160 acres, the effects of scale are not exhausted. According to his analysis, per acre net income on an average site is reduced by about 25% at a size of 50 acres. Row's results may seriously underestimate the effect of scale, however, because his data relate to costs and revenues of various sized tracts owned by the U.S. Forest Service, but managed and cut under contracts let by competitive tender; hence a number of scale disadvantages suffered by woodlot owners are excluded. (See also Mills 1976.)

The spruce budworm (which primarily attacks fir and spruce) poses a special difficulty for New Brunswick's woodlot owners because it continues to damage their woodlands more than others (Clowater and Andrews 1981). This arises from the proximity of woodlots to dwellings, around which a "no-spray" set-back zone has been established. Woodlots will likely continue to be excluded from aerial spraying with chemical agents, as the boundaries of this zone are blown to and fro by changing political winds (c.f., Reed & Associates 1978,

p. I-1-26). Furthermore, woodlot owners collectively are less able than other owners to deal with this extremely destructive infestation, primarily because they have no mechanism for reaching joint decisions on harvesting.[61] At the present time, these factors are generating an extraordinary supply of stumpage from woodlots, a high proportion of which is salvage and presalvage. Hence there is continuing downward pressure on woodlot stumpage rates. Experience indicates that the budworm epidemic will likely persist, yet with major fluctuations, since the most severe outbreaks manifest themselves when a high proportion of the forest is mature or overmature (Miller and Varty 1975, Baskerville 1975, Place 1978). Whether silviculture which reduces the fir/spruce component of the woodlot inventory in favour of other fast-growing, high-value species might be beneficial is disputed (McCrea 1979, Falk 1979, Einspahr et al. 1984; and also Baskerville 1975, and MacLean 1982b). Despite major research efforts on the budworm problem, no other cost-effective solutions for woodlots are in sight. Since future incomes from woodlots depend absolutely on harvestable trees growing to maturity, the budworm introduces a monumental uncertainty to prospective returns from current woodlot management activities.

Three further disabilities disproportionately affect small timber investments: illiquidity, risk and income taxation. Such investments are difficult if not impossible to insure and to use as collateral. Large industrial holdings offer prospects of more frequent flows of revenue and diversification by location and species. Moreover, tax treatment -- particularly of management outlays -- is generally more favourable. All these factors reduce the attractiveness of investment by woodlot owners in silviculture by lowering anticipated profit, increasing marketing uncertainty and reducing the time horizon. There are some offsetting advantages of being small, though. Raup (1978) has pointed out that the smallholder may be able to provide or hire lower-cost

labour inputs than his industrial counterpart. And he may employ labour and equipment (e.g. farm tractors), which would otherwise be idle. Furthermore, the amenities derived from ownership may cover much of the cost of holding land and timber (although not the cost of silviculture), thus improving the profitability of "by-product" timber sales.

Stumpage Prices and Decisions to Harvest and Manage

When forecasting the level of real (i.e., inflation-adjusted) stumpage prices, the present is doubtless the most reliable guide to the future. Other influential factors can reasonably be projected. However, the degree of reliability diminishes as the future to be predicted becomes more distant. An unexpected upward shift in current stumpage prices raises potential returns to woodlot owners from immediate harvesting, increases the subjective sense of uncertainty about the future, and gives rise to differing perceptions regarding the probable course of future prices. In light of these effects, let us consider the decisions to harvest and to invest in forest management (c.f., Clawson 1977).

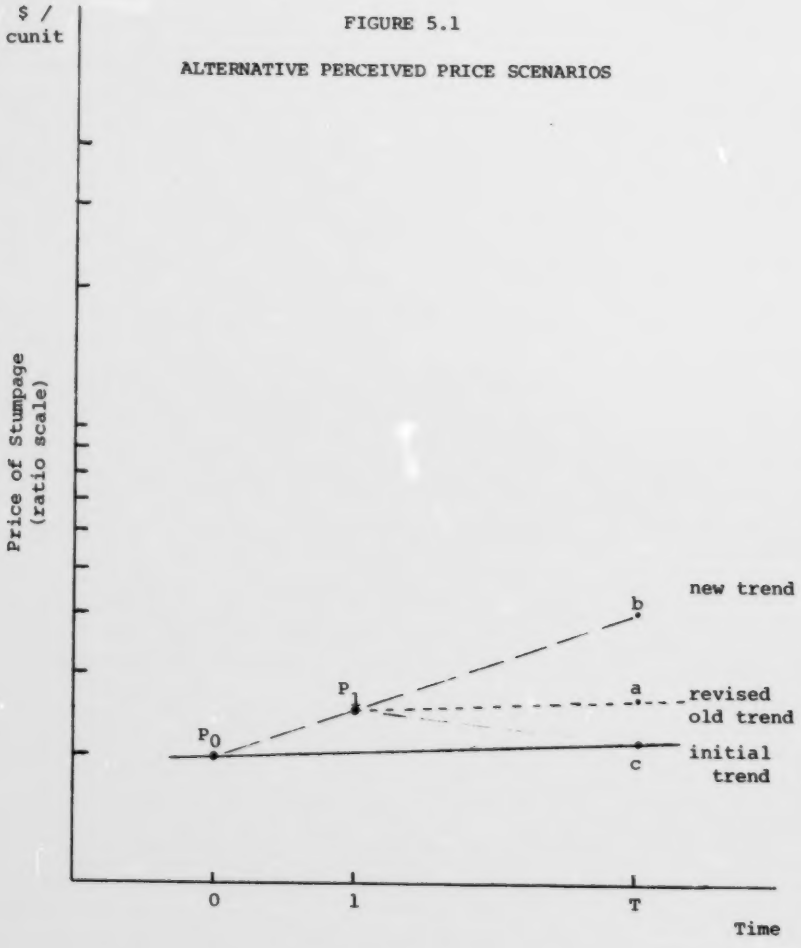
On the basis of an initial actual real stumpage price increase from P_0 to P_1, three alternative perceptions of the likely real stumpage scenario are distinguished in Figure 5.1:

a) the initial price change is perceived as an isolated one-time event affecting the level, but not the trend of future prices,
b) the price change is thought to establish a new continuing trend, and
c) the price change is regarded as a deviation above (or below) the anticipated trend.

In this diagram, the solid line indicates the initially perceived long-term trend, point P_0 the initial stumpage price, and point P_1 the new unexpected price off the initial long-term trend. The level of prices expected at some future time, T, under the different subjective scenarios are indicated

FIGURE 5.1

ALTERNATIVE PERCEIVED PRICE SCENARIOS



respectively by a, b, and c. In contrasting these scenarios, bear three points in mind. First, stumpage prices are in real terms. Hence, costs for silviculture and prices of other products are unchanged. Second, any increase (or decrease) in the expected level of future prices results in a corresponding increase (or decrease) in the value of the bare land for growing timber, and hence an immediate potential unrealized capital gain (or loss). Third, liquidation of the existing forest inventory enhances the resources available to the owner for new investment in forest management, while restricting the possibility of applying them to mature stands.

Influence of the price change from P_0 to P_1 on an owner's decisions to harvest or to invest in forest management will depend on his interpretation (i.e., perception) of the change, and the subjective probabilities he assigns to the alternative scenarios. Since owners differ, a given actual change in price which triggers consideration of these future price scenarios will give rise to a variety of interpretations among owners and consequent variations in behaviour. For each owner, the harvest decision will depend on the perceived balance between anticipated benefits from holding the stand intact versus those from harvesting now, taking into account future benefits from reinvesting the stumpage revenue and changes in the timing of future harvests during subsequent rotations (Clawson 1977, p. 43), as well as any loss of aesthetic values (Hartman 1976). Specifically, should the anticipated growth rate of the net value of the timber exceed the interest rate which could be earned on the stumpage revenue from an immediate harvest, plus an allowance for acceleration of future harvests and an adjustment for the loss of aesthetic benefits, cutting will be deferred, and vice-versa (Jackson 1980, pp. 21-25 & 44-45; Samuelson 1976; and Huber 1983). (In other words, a rational owner will compare the expected present value of an immediate versus a delayed harvest, taking into account long-term as well as short-term differences in cash flows; and will choose the

option with the larger expected present value.)[62]

Scenario (a) involves little change in the underlying expected growth trend of the stand's value net of costs, and hence little change in the attractiveness of immediate harvesting.[63] In the example shown, scenario (b) presupposes an increased rate of growth of value; hence delay in harvesting becomes more advantageous relative to the initial situation. In contrast, the current stumpage price in scenario (c) is transitory, sharply raising the perceived balance of the benefits of immediate harvesting relative to the costs. Particularly for sawlogs, price fluctuations such as in case (c) may dominate biological variations in forest growth, and hence be the key to rational forest harvesting decisions by smallholders (Clawson 1977, p. 45 & p. 56).[64]

Under both scenarios (a) and (b), changes in the anticipated level of future prices occur, but in the latter case, more dramatically. Future expected payoffs to silvicultural activity change correspondingly and the shift in the marginal revenue product of silvicultural effort may be disproportionally larger if extraction costs are significant (Hyde 1980, pp. 203-206; also Jackson 1980). Nevertheless, these payoffs are long in the future, the immediate resources of the owner are unchanged, and his incentive to cut immediately is either unchanged or reduced. The sensitivity of actual silvicultural activitiy to this increased return depends on the goals of the forest owner, his willingness to tolerate risk over long periods, the technological possibilities of converting forest management inputs into timber outputs at the scale of operations of the owner, the current levels of management practiced, returns on alternative uses of the owner's resources, and the distribution of these characteristics among woodlot owners in the area where the price change manifests itself. In particular, the extent of the improvement in return may be critical; superior returns from alternative investments may constitute a substantial

threshold to be overcome.

On the other hand, in scenario (c), short-run harvesting increases, and resources become available to invest; but the payoff to silviculture is unchanged, because anticipations of future prices do not change. The difference in the impact of a price increase between scenario (c) and scenarios (a) and (b) clearly implies that increased management effort is attractive only when increased harvesting is not, and vice-versa. Although, as Clawson (1977) points out, availability of markets and short-run cash famines may override the influence of price, nonetheless, it is widely held that harvesting responds positively to price (Sedjo and Ostermeier 1978; Binkley 1981, pp. 77-81; USDA 1978, p. vii). Such a positive reaction to price suggests that scenario (c) dominates the perceptions of woodlot owners, implying that little or no impact on silvicultural effort can be expected.

> Experience shows that while substantial increases in stumpage prices do lead to increased timber harvests, they do not lead to much greater investments in tree planting or other management activities by the owners of nonindustrial forest lands. But experience ... also indicates that these same owners will substantially increase such investments when stimulated by cost-sharing or other direct incentives--when such programs are operated on sufficiently large and stable bases.
>
> (USDA 1978, p. vii)

Conclusion

The non-industrial private forestry (woodlot) "problem", one of the most celebrated in the silvicultural literature, is in essence the extent of forest management practiced by woodlot owners. Several aspects have been briefly reviewed in this chapter:

- whether forest management on woodlots is less intensive

than on industrial holdings;

- whether there is or will be a timber shortage which management of woodlots can help resolve;
- if there is such a shortage, whether woodlot management will help resolve it; and
- whether higher stumpage prices will lead woodlot owners to increase intensity of forest management and hence supply more timber in the future.

Forest management involves the application of labour, equipment, know-how and supervision at the present time to try to expand forest outputs in the future. As with other investment activities, a decision to introduce or expand forest management depends on the availability of these inputs and on the anticipated rate of return relative to alternatives, given the preferences of the owner and his scale of operation. Regrettably, one faces serious data problems in analysing these factors. Nevertheless, a number of limits on resources available to woodlot owners were discussed in a general way, the most serious of which appear to be

- lack of long-term financing;
- shortage of knowledge, skills and time;
- difficulty in securing satisfactory logging contractors.

The most important result regarding the goals of woodlot owners was that while most are not in principle against harvesting, few regard timber production as their main ownership goal. (This is of course not inconsistent with wanting a favourable price when marketing their timber.) Given this orientation, many owners are not interested in, or informed about, forest management for timber production. Why invest time, energy and money in acquiring information and know-how to manage a woodlot for timber production, when the major output from management is undesired?[65]

Pronouncements of experts, empirical "experiments" and application of yield information from the literature, timberlot case studies, and anecdotal evidence were reviewed as sources

of information on rates of return to timber growing and to various forest management activities under conditions similar to those in New Brunswick. The apparent divergence in opinion is remarkable, notwithstanding the diversity of forestry situations. However, sober appraisal reveals inflation-adjusted rates of return to forest management for softwood pulpwood production of, at best, four percent per annum under favourable conditions. As alternatives, essentially risk-free term deposits have averaged 3%, and common stocks about 6% real return over long periods; hence illiquid and risky investments in forest management cannot generally be justified by their rates of return.

Nor are they. Industrial forest operations carry out silvicultural activities as a cost of staying in business. Moreover, because of their corporate scale, they possess a significant margin of advantage over woodlots, even when the latter are managed for timber production and the owner faces no constraints on forest management inputs. The relative disadvantages distinguishing woodlots from industrial forest holdings were identified as:

- total dependence on external markets for sales of stumpage;
- absence or unreliability of markets for some products and species;
- unwillingness or inability to enter into long-term commitments; and
- lower unit revenues and higher unit costs, in part because of unfavourable income tax treatment.

If larger immediate harvests result from higher inflation-adjusted stumpage prices, this implies that owners generally regard the price increases as transitory, and hence perceive no change in the incentive to engage in management effort. This is the key finding of the final section, which focuses on the relationship among stumpage prices, decisions to harvest and incentives to engage in forest management. It is

particularly relevant in the context of the challenges facing New Brunswick forestry: a sellers' market from 2000 to 2020, followed by a buyers' market in which quantities supplied will likely be more than sufficient, even though qualities may not be. Prices under most management regimes will therefore not trend steadily upwards as in Figure 5.1, but instead likely kink downward after 2020, unless an expansion of the Province's wood-processing industry occurs.[66] This possibility, along with the prospect of future budworm infestations, increases uncertainty regarding future price and woodlot output levels and reinforces perceptions of woodlot owners that current stumpage price levels provide a less than solid basis for long-term forest management decisions.

CHAPTER 6

OPTIONS FOR PUBLIC POLICY

Introduction

The message of the preceding three chapters is clear: by themselves, existing forest policies are unlikely to induce significantly improved woodlot management in New Brunswick. The presumed causal chain which was examined contained five links, running from legislation regarding Crown forests and marketing boards to increased demand for timber from woodlots to higher delivered prices and then higher stumpage rates. It continued to higher profits for woodlot owners and thence to higher management intensity. Every link was found to be weak.

If these policies are not likely to work, one naturally inquires whether alternatives, focusing directly on private forest management rather than relying on indirect and uncertain causation, might succeed. Given the long history of the "woodlot problem" in Europe and the United States, there is ample experience to draw on for examples.[67] Individual jurisdictions have dozens of laws, regulations and programmes affecting forestry; for example, Field (1982c) identifies seven land-use statutes alone in Maine. Hence, there must be thousands of such policies in the Western world as a whole.[68] And the number of proposed laws or programmes is far

greater. Hundreds of specific suggestions were made to the New Brunswick Private Woodlot Resources Study (N.B. 1983). To analyse in detail the effects of one or two programmes in a single jurisdiction is a major undertaking;[69] hence, it is clearly beyond the scope of the present study to deal with the full range of woodlot policies which might be considered for New Brunswick. Instead, the discussion below centres on the proposals made in the Report of the New Brunswick Private Woodlot Resources Study, Private Woodlots: What Does the Future Hold? (N.B. 1983; hereafter, Study's Report).

In assessing policy options, one must remember at the outset that government intervention was justified in Chapter 1 to neutralize market imperfections which induce owners to make decisions which are reasonable from their individual perspectives, but sub-optimal from a social point of view. This divergence in perspectives is fundamental in developing policy: the goal of the Province is to ensure the future of its wood-processing industry, and the employment and income which depends on that industry, but woodlot owners' concerns are quite different. As we observed in the previous chapter, they want protection of the amenity from their woodlands, flexibility with respect to converting the value of their land and timber into cash, an adequate and rapid payback from investment outlays, and minimization of risks endangering amenity, liquidity, and investment.[70] If public initiatives to promote forest management are to be successful, they cannot afford to neglect these private concerns. Other barriers to engaging in forest management must also be taken into account; and effects on employment and on the distribution of income and wealth cannot be disregarded. As Irland (1982d) has pointed out, conflicts between political feasibility and efficiency characterize a number of public forestry programmes.[71]

These considerations lead to some general propositions about the appropriate structure of policies to promote woodlot management:

- The optimal point to intervene to promote forest management is when harvesting occurs. Not only is quality of cutting critical to regeneration and hence silviculturally important, but on most woodlots, now and in the foreseeable future, logging is the only silviculture that will be practiced (c.f., Irland 1979, p. 59). At that point in the rotation period, the owner has financial resources available. Moreover, given the level of owner dissatisfaction with loggers, it is clear that major improvements in harvesting performance are possible.
- Markets and utilization, particularly of low-grade material, are the key to the financial viability of thinning operations, and hence the rehabilitation of small forest holdings (Bickerstaff, Wallace and Evert 1981, p. 118; Irland and Hermelin, personal communications). The fuelwood boom has created a unique, but perhaps brief, opportunity to make major silvicultural improvements (Field 1982b). Development of markets for such forest outputs is a difficult but significant challenge to which Government should continue to respond.
- Efforts to improve the level and the predictability of rates of return on woodlots by introducing fast-growing species, changing tax laws and regulations, and improving research and extension may be important, but must be tailored to the needs of the smallholder.
- Development of awareness of the ecological importance of forests, the possibilities of multiple use of woodlands, and the private amenity arising from forest management is potentially of paramount importance.
- Protection from future budworm devastation and salvage of existing budworm-damaged stands are doubtless among the most important measures which can reduce the risk of forest management decisions by non-industrial owners.

- Political considerations favour universality; cost-effectiveness however, requires programmes structured to focus little on owners who already have adequate incentive to manage, and heavily on those with large holdings who are not yet sufficiently motivated.
- Woodland which has benefited from public incentive programmes must in some fashion be tied to a long-term management commitment which is transferred with the land to bind subsequent owners.
- Given economies of scale in forest management, consolidated arrangements to provide forest management to woodlot owners collectively are likely to be more cost-effective, and hence warrant encouragement; they should be eligible for the same cost-sharing and other assistance as the individual owners.

Proposals of the New Brunswick Private Woodlot Resources Study

Let us relate these general propositions to the proposals in the Report of the New Brunswick Private Woodlot Resources Study, issued in December 1983, after over two years of hearings, research, and deliberation. It made nearly forty "suggestions" and more than a dozen recommendations for improving woodlot management in the Province. The primary thrust was toward beefing-up the role of the Province's forest product marketing boards. It recommended that these woodlot owner organizations should

- take over delivery of extension services to woodlot owners;
- become the chosen vehicle for administering Federal and Provincial forestry incentive programmes directed at these ownerships;
- "guide" contractors with respect to harvesting practices
  a) by ensuring availability of adequate training in harvesting, maintenance of machinery and silviculture,
  b) by assisting owners in assessing the value of their

standing timber,

c) by establishing standard buyer-seller contracts for harvesting timber, and

d) by directing contractors to areas most in need of cutting;

- administer a reinstated "certified tree farm" programme in the Province, involving bonus payments for pulpwood deliveries from such farms;
- plan and implement woodlot harvesting, marketing and forest renewal on a regional basis within the Province; and
- negotiate and carry out joint projects with industry for pooling equipment and providing nursery stock.

The Study's Report made no suggestion that the marketing board legislation might require amendment; instead it urged the boards to examine their experiences and operations and revise their current structures to accommodate the proposed extension of responsibilities. At the same time, the Report recommended that means be designed (presumably by the boards) for ensuring that owners maintain control of these organizations, which should be kept fully accountable as well to the public.

Also proposed was a redirection and restructuring of financial and tax incentives

- to provide specifically-tailored income tax treatment for small woodlot operations (instead of treating them as "tax orphans"),
- to give priority in allocating Federal and Provincial funding for small-scale forestry to "activities directed towards sustained wood production" (p. 88),
- to assist in rehabilitating budworm-devastated woodlots, and
- toward ensuring an adequate supply of nursery stock.

Finally, it was recommended that industry buying practices be reoriented

- toward the purchase of more budworm-damaged wood and

- toward the utilization of a broader variety of species.

In addition to these recommendations, Private Woodlots, What Does the Future Hold? suggested improvements related to small-scale forestry in

- education, training, research and development, and technical assistance,
- protection measures and timber "crop" insurance, and
- Provincial property and sales taxation.

Further suggestions were made that governments focus more precisely on non-industrial woodlots as a distinct entity, promoting

- a long-term approach in financial assistance programmes,
- the cooperative acquisition and pooling of expensive equipment and other resources,
- land consolidation for the purpose of forest management,
- job creation in non-industrial silvicultural projects, and
- a thorough review of the impact of the Income Tax Act on incentives for non-industrial forest management.

It is difficult to disagree with the overall tenor of these recommendations and suggestions. But in light of the analysis in earlier chapters, several specific features deserve review. We consider these proposals under headings related to regulation, incentives, industry behaviour, and systemic change (c.f., Skok and Gregersen 1975).

- Regulation -

Governmental or paragovernmental (e.g., marketing board) regulation of private forest land use may be aimed at woodlot owners, contractors, and processors. Four areas of regulation are common elsewhere:

- environmental protection,
- limits on harvesting (e.g., only designated trees may be cut),
- requirements for adequate regeneration, and

- control of land-use, subdivision, development and consolidation.

In the United States, putative bastion of free enterprise, over a quarter of the states now regulate harvesting practices or require reforestation or regeneration (Meeks 1982, pp. 19-20). Several other states have voluntary guidelines. New Brunswick is making a similar transition from forest exploitation to tree cropping, and hence now faces a corresponding need to ensure the prompt renewal of its cutover forestlands. It has taken action respecting public lands. But, despite emphasis on planned harvesting, marketing, and renewal of non-industrial forests under the administrative aegis of regional marketing boards, Private Woodlots: What Does the Future Hold? is fundamentally unsympathetic toward regulatory initiatives which will limit the freedom of woodlot owners to mismanage their woodlands.

Whether the Province can afford this luxury is not clear. The economic benefits of adopting harvesting standards appear substantial; no suggestion appears to enjoy more widespread support in all segments of the industry. The effectiveness of such an initiative could be enhanced, and its political costs (if any) minimized, by imposing the requirements on logging contractors. They are the ones responsible for most harvesting, and because of their major dependence on forestry, they are generally likely to be economically sensitive to the penalties which might result from non-compliance. Introduction of such standards would require a major educational and training programme, along with appropriate publicity. Enforcement would have to be flexible, allowing for regional differences and variations in sites, and relying heavily on local initiative; although armed with teeth, it would want to operate with a large element of persuasion and peer-group pressure, and a minimum of bureaucratic and legalistic rigidity (c.f., Stjernquist 1973).

At the same time, standardized contracts governing the

sale of stumpage and the harvesting process could partially equalize the bargaining power of contractors and owners, thus improving the level and the predictability of stumpage rates. The superior market knowledge and economic power of contractors would be somewhat offset, and the harvesting "rules of the game" would then be clear to both parties.

Marketing boards could readily draft harvesting and contractual standards; and if given additional powers, implement and enforce them. These boards already possess the ultimate sanction: denial of delivery privileges ("tickets") to contractors. Potentially, the boards provide an excellent "grass-roots" system for improving the practices of the minority of logging contractors who harvest irresponsibly. However, as analysed in Chapter 3, several boards are dominated by contractors; there is doubt whether they could carry out such functions in the best interests of woodlot owners. Moreover, despite its recommendation that the boards be accountable to owners and its proposal of self-reform, the Study makes no case that contractor-dominated marketing boards are capable of self-reform, or indeed, that other marketing boards can avoid being taken over gradually by contractors. Without a modification of the regulations chartering marketing boards with the goal of eliminating the present dominance of contractors, benefits from an expanded role for marketing boards will be seriously jeopardized.[72]

The proposal that marketing boards institute a dual price system favouring managed woodlots is also problematic. Aside from the administrative difficulties and the potential abuses entailed by such a system, the rewards might be captured by contractors rather than owners. If not, they would flow primarily to those already committed to (some?) management with no assurance that they would be used for additional management. In administrative simplicity, acceptability, fairness, and linkage to additional forest management, it would be better to set up forest management funds under other marketing boards

following the model negotiated between the SNB Marketing Board and the J.D. Irving interests.[73]

- Income Taxation -

Under the Income Tax Act, farmers, contractors, Christmas tree growers, and woodlot owners with large holdings will have little difficulty in securing treatment of silvicultural outlays consistent with that accorded business expenditures generally. For other woodlot owners, restrictions on deductibility and capital gains taxation at death seriously affect willingness to make outlays on silviculture. Deductibility of any expense from income under the Act is possible only if the amount is "reasonable" and was made for the purpose of gaining or producing income. In other words, silviculture must be carried out as a business activity in a systematic way and with a reasonable expectation of profit within the taxpayer's lifetime. This creates two problems: the fifty percent of owners who are over 50 years of age cannot have a reasonable expectation of profit from reforestation outlays; and holdings under 100 acres scarcely justify efforts to convince Revenue Canada that periodic silvicultural activities are indeed "systematic".[74] Even if these hurdles are overcome, "hobby farm" provisions limit full deductibility of losses in any one year to $2,500.[75] Since site preparation and planting on an average-sized holding can cost $25,000, and pre-commercial thinning is expensive too, this limit is an impediment to forest management outlays by the increasing number of blue and white-collar owners who have adequate resources. Income taxation of capital gains deemed to have been realized at death is similar in its effects on forest management to inheritance taxation (on which there is a substantial literature, inter alia, Jackson 1980, ch.4). The combination of inflation and forest development since the introduction of capital gains taxation in Canada in 1971 ensures that income taxes levied on timberland at death will become increasingly onerous in the next few years. The obvious

result, given the difficulty of borrowing against timber collateral, will be harvests or land sales unrelated to market strength or timber maturity.

Changing the Income Tax Act to recognize fully the unique characteristics of forestry, as recommended by the Study's Report, is one way of dealing with these problems; another is institutional innovation aimed at enabling woodlot owners collectively to receive tax treatment for which they may be individually ineligible.

- Property Taxation -

Annual property taxes in New Brunswick on woodlot acreage run roughly 38 cents per acre, effectively equalling residential rates applied to a bare land value of $25.00 per acre. There is no yield or severance tax, so the value of standing timber is untaxed. Although such a property tax system provides no incentive to engage in forest management, the Study's suggestion to lower property tax levels on "managed" or "registered" woodlots will have little effect unless the level of taxation on unmanaged forestland is sharply raised. Recently there has been considerable interest in the impact of property taxation on forest management; indeed a third of the U.S. states have modified their forest land taxation in the last decade (Meeks 1982).

There are a variety of alternative property tax regimes for non-industrial woodlands which New Brunswick might consider. For example, some jurisdictions, such as Massachusetts, assess forest land at full market value, but if it is "classified" by adhering to an acceptable forest management plan, a major portion (about 80%) of the taxes due is remitted. Under the provisions of Chapter 61 of Massachusetts' statutes, a yield tax of 8% of the stumpage from "classified" land is imposed, and if such land is removed from management, all past tax remissions plus compound interest must be paid as a penalty (Kronrad and Harou 1982).[76] Administrative costs of reviewing, certifying, and policing management plans

are considerable. Moreover, benefits have been estimated to be far less than the tax "expenditures" involved, since much of the tax remission accrues to owners who would have managed their woodlots in any case (Kronrad and Harou 1982, pp. 79-81). However, given the present low level of taxation on unmanaged forest land in New Brunswick, this sort of approach might both increase revenues and forest management simultaneously.

As an alternative example, Finland has a timber use-value tax, based on the average net income a woodlot would produce (given its site-quality and general location) if managed at the average level prevailing in that area (Holopainen 1981, pp. 30-31). Exemptions are provided for newly afforested, regenerated, and drained areas. The effect of this system is to reward those who manage more successfully than average, and penalize below average managers including those who do not manage at all. Once forestland has been assessed with respect to site-quality, the administrative costs of this sort of tax regime are no greater than those of the normal reassessment process. Without exemptions, such a fiscal system would only indirectly promote woodland management; and for exemptions to have much impact, the average level of taxes on woodlot lands in New Brunswick would have to be increased substantially (c.f., Field 1982a, esp. p. 16).

- Development Subsidies -

The Canada-New Brunswick General Development Agreement and the Forestry Employment Programme provide for cost-sharing of reforestation, road-building, boundary maintenance, and thinning. (In addition, Christmas tree and maple sugar operations receive assistance; this is not considered here.) Cost-shared programmes are fiscally burdensome; economically, if they reduce unemployment, they may yield a favorable balance of benefits and costs. Perhaps inevitably, the local allocation of funds is criticised in parts of the Province. As well, coordination between silviculture and subsequent harvesting is reputed to have been deficient.

Delivering these programmes through marketing boards, as proposed by Private Woodlots: What Does the Future Hold?, will ensure a high degree of local control, and possibly reduce some existing duplication of effort. Nevertheless, a large impact on forest management is unlikely if this proposal is implemented in the form outlined in the Study's Report. In the first place, few acres are treated relative to the total woodlot resource. For example, in 1981-82, the Forestry Employment Programme administered by the New Brunswick Federation of Woodlot Owners carried out silvicultural activities on about 5000 acres, i.e., 0.1% of the Province's woodlot acreage (1982-83 Report). At this rate, less than one-twentieth of the woodlot resource would be affected in the course of a rotation, assuming only one treatment on any given acreage. Moreover, whether thinning has been sufficiently emphasised is questionable, given the shortage of funds and the need to deal with the medium-term supply problem. Yet this is one of the few avenues to improved harvests in the "famine" period, and hence will yield higher as well as faster paybacks to owners and to society. Secondly, there is the problem of retaining treated acreage under management. If grant recipients are not obliged to continue the management of forests to maturity once forest management has begun, or to repay their grant with interest (for example, by providing cost-shared funds as contingently forgivable loans), public funds and private effort may not result in expansion of future timber supply. Unfortunately, the Report does not squarely address these two key features of existing cost-shared arrangements.

- Other Incentives -

In the past, the Province and some of the major companies have supplied woodlot owners with seedlings on a cost-shared basis. Since planting nursery stock is an excellent way of introducing genetic and species improvements, and since scale of operations precludes woodlot owners from supplying

themselves, this made eminent sense. However, some woodlot demand has not been met on a timely basis with satisfactory seedlings; when this occurs, an obvious dampening of the enthusiasm of owners for planting ensues. Certainly, adequate nursery capacity is essential to the success of any planting programme, and marketing boards will likely be more responsive to woodlot owners' needs in this respect.[77]

The effects on woodlot management of research and development (and other activities such as highway improvement) are diffuse and difficult to quantify. Doubtless, in the long-term, they are positive, however. There is some evidence (N.B. Legislature 1981, pp. 11-12) that forestry education and training has been underfunded; however, in recent years, it is believed that the level of forestry professionalism in New Brunswick has sharply improved. This, too, may be of long-term significance. Education, extension, and training programmes for owners, logging contractors, woods-workers, and professional foresters should be commensurate with the importance of the industry to New Brunswick.

To some extent, operating assistance (e.g., drafting of management plans, marking of trees), and marketing assistance have already been transferred from the Government to the marketing boards, and the Study recommends a complete devolution. This may succeed in orienting these functions better to the needs of woodlot owners, rather than those of the loggers, the wood-processors, or the Crown. Hopefully, the marketing boards will also put in place systems for gathering and reporting data on markets, including stumpage prices for various species and qualities in the different parts of the Province (c.f., Clawson 1979). The Report is also encouraging with respect to development, testing, demonstration, and pooled operation (by marketing boards) of equipment and machinery suitable to woodlot-scale operations (Irland 1979 and Hermelin 1982).

When ownership is unclear, or access difficult or

impossible, investments will not be made in forest management. The history of land grants and settlement in New Brunswick has created many cigar-shaped woodland holdings, with consequent difficulty of access to middle and rear portions of lots. Moreover, many base lines for the rear boundaries of the grants need to be rerun. Unclear property boundaries of this type create problems extending beyond forestry, and can be resolved at reasonable cost only through governmental initiatives to reestablish the corner posts and base lines of grants. Exacerbating this problem is the subdivision of small private forest lands in the Province. As analysed in Chapter 5, the resulting fragmentation of forestland reduces the return, and hence the likelihood of woodlot management. The situation by no means approaches that in the European Economic Community (Harou 1981), where there are programmes of agricultural and silvicultural consolidation, and this doubtless is not a crucial influence on the rate of return to woodlot management. Nonetheless, despite the Report's opinion "that land consolidation has only limited potential in New Brunswick," (p. 66) the Provincial government might wish to weigh seriously the possibility of restricting subdivision of forest lands, and introducing incentives for consolidation.

- Industry Behaviour -

Landowner assistance programmes of varying types are operated by nearly every major forestry firm in the United States, but are in their infancy in Canada. Even though LAP's operate successfully across the border in Maine, woodlot owners in New Brunswick have reservations about technical assistance from the major wood-processing companies; perhaps this reflects lack of experience with such assistance and the tightness or looseness of the strings which might be attached. Since some of the benefits from a larger timber supply from woodlots will flow to the wood-processing firms, they have a stake in forest management on woodlots. Hence, inducing licensees and sub-licensees in the Province to do more to assist woodlot

owners would be appropriate.

However, the Report's only recommendation in this direction is that industry buying practices be reoriented toward an input mix which more closely approximates timber availability from woodlots. If this happened, it could be of short-run and long-run significance in relaxing supply constraints and raising returns to woodlot owners. For example, increasing the harvest and utilization of budworm-damaged timber from woodlots would help to stretch out Provincial timber supplies into the "famine" period by using biomass which would otherwise simply rot; at the same time, more rapid regeneration -- even without planting -- would take place on the cleared acreage.[78] Regrettably, the long-run self-interest of wood-processors has not moved them to implement this recommendation, and policy measures which would accomplish such desirable results are neither suggested nor discussed in the Report.[79]

- Systemic Change -

The recommendations of Private Woodlots: What Does the Future Hold? imply a major increase in the responsibilities of marketing boards. How this will be financed, and whether the boards will prove equal to the tasks thrust upon them is unclear.[80] It may be useful, therefore, to sketch some other possible approaches to institutional innovation:

- establishment of a Provincial Forestry Bank to lend to woodlot owners for forest management on the basis of timber collateral;
- establishment of a New Brunswick Timber Crop Insurance Scheme;
- formation of a New Brunswick Private Timberland Leasing and Management Trust (c.f., N.B. Legislature, Select Committee 1981, p. 10; Stoddard 1978);

The first two of these would be aimed at reducing risk and illiquidity of investments in forest management. They could operate as Crown corporations or as profit-making entities with

both public and private capital. Access to their services would be limited to woodlot owners who undertook to engage in systematic forest management. Agricultural lending and insurance schemes provide an appropriate, if shorter-term, analogy.[81]

A timberland leasing and management trust, along the lines proposed by McAllister or Stoddard, might be envisaged to take over woodlot management under long-term renewable trust agreements or leases, which would guarantee access to the owners for purposes of recreation, hunting, etc. The goal would be to make profits by managing substantial blocks of contiguous non-industrial timberland on a consolidated -- and hence more efficient -- basis. Although aimed at larger, municipally-owned or county-owned holdings, the Ontario MNR Agreement Forests Programme is a prototype of a flexible arrangement of this sort (Ontario, MNR 1982, pp. 41-53). To get started, bridging the period up to initial harvesting, substantial initial funding would be required (possibly in the form of long-term low-interest loans from the Government). Such a scheme would have to be structured to take advantage of favourable tax incentive provisions, to allocate expenses and income fairly and -- from their perspective -- advantageously to the lessors, and to motivate those running the organization. In its start-up phase, the Trust might face a severe shortage of managerial and professional manpower, but presumably it could contract out silvicultural work. However, because of the conflict of interest which would arise when marketing timber from such an organization, it would appear unwise to make marketing boards responsible for the Trust's operation.[82] Experience with institutional innovation in other sectors suggests that the successful introduction and development of such an organization would require a long-term commitment of effort by individuals and groups dedicated to the concept.

Forest Policy and the "Woodlot Problem"

Perhaps forest policy is barking up the wrong tree in attempting to find solutions to the so-called "woodlot problem." Certainly this review of existing and proposed measures in New Brunswick suggests that considerable legislative, administrative, and financial effort is likely to yield rather modest results, both in terms of increased woodlot management inputs and future timber outputs. It is appropriate, therefore, to restate the key forest policy issues at this point, and then, in a broader context, to raise the question, which thus far has remained dormant: whether special measures to induce more intensive woodlot management in New Brunswick are necessary or even desirable.

As we have observed in earlier chapters, a medium-term softwood timber "famine" is projected for 2000 to 2020 in New Brunswick, but thereafter allowable cuts are thought to be adequate to permit expansions in the Province's wood-processing industry. Thus there are two distinct supply problems. The short-run goal is to avert threatened contraction, the long-run aim to permit desired growth in both quantitative and qualitative terms.

Woodlot management options to deal with the projected shortage of softwood pulpwood in New Brunswick during the period 2000 to 2020 are very limited. Indeed, according to Watson (1983, pp. 15-16), maximum silvicultural effort in New Brunswick could increase the sustainable harvest from woodlots for this period by only 18 percent (i.e., 260,000 cubic metres), although from the industrial forests of the Province, an increase in sustainable harvest of 42 percent (1,550,000 cubic metres) is thought possible.[83] In addition to silvicultural options, wood-processors might improve fibre-utilization (possibly by using more hardwood) and import timber during the "famine" period; also harvesting might be induced or forced on lands whose owners have been unwilling to cut. Because of limited timber supply in the shortage period,

New Brunswick's wood-processing industry and its employees will benefit from an even modestly expanded timber supply resulting from woodlot management; operations can closer approach the full-capacity level. However, higher stumpage prices in this period should generate a flow of gross benefits to woodlot owners as well.

In the long-term, the primary justification for expanding timber supply from woodlots is the benefit which will accrue to the wood-processing firms and their employees as a result of improved quality and increased supply, and hence lower stumpage prices than otherwise would have prevailed (c.f., Watson 1983, pp. 27-30). Although management options for generating increases in timber supply in the period after 2020-2030 are increasingly unrestricted, prospective benefits to woodlot owners are elusive. This is the nub of the woodlot problem in New Brunswick. Inducing long-term woodlot management in the Province is therefore a "hard-sell" (Baskerville 1977). As a result, education and the "woodland ethic", not economics, may be the only cost-effective approach to stimulating woodlot owners to practice better forestry.

In one sense, forest policy will be successful if each of the above-mentioned supply problems is met within its relevant time-frame. Ultimately, however, the proof of the forest policy pudding is in the net income generated through harvesting and processing timber (and the income and amenities derived from other uses of the forest) in the course of the next two generations and beyond. In other words, forest policy success means that all the people of New Brunswick in the future receive from the Provincial forest resource, both public and private, a continuing substantial stream of benefits net of associated costs.[84]

Approaching forest policy in terms of net future incomes and amenity from the entire Provincial forest resource has at least five corollaries:

1. Better trees and forests are not ends in themselves, but

means to the end of better lives for New Brunswickers. The ultimate goal is not technological or biological, but social.

2. Not forest management itself, but rather the increase in amenity and in the value of future timber harvests associated with forest management constitutes the potential gross benefit. This will not in fact be realized unless subsequent required treatments are carried out, the treated forestland is retained until maturity, and it is harvested (Irland 1982c, p. 15; Field 1982c, p. 28).
3. Forest management activities and their associated benefits are not free; they use up resources and inputs which could be used for other purposes. Benefits must be netted of the costs necessary to generate them.
4. By including amenity (psychic income), environmental concerns and perceptions are given due weight; at the same time, suggested regulatory constraints on private forest ownership involving a substantial reduction in amenity to woodlot owners (LeBlanc 1981) may be taken into account.
5. The current forest management costs required to avert a potential contraction in wood-processing activities in the future are not automatically acceptable regardless of their level; if forest management activity at some level of intensity generates positive net benefits, then the optimum level of intensity needs to be determined. At the margin, the currently incurred costs should be no larger than the present value of the future benefits.

The costs of increasing forest management are not necessarily equal to the dollar outlays made by Government to promote it, and by private owners to carry it out. Some inputs used for forest management might otherwise have been unemployed, and hence cost society nothing; some cost-sharing payments might be made, even though the owner would have

carried out the work without subsidy; and some inputs might be used, but not fully charged to forest management. Theoretically, one should measure cost as the benefits which New Brunswickers would have enjoyed if the inputs put into forest management as a result of government programmes had been employed in their most productive alternative use. This theoretical ideal is obviously difficult to calculate, as are less theoretical alternatives.[85] The key point is that the balance of costs from management outlays and benefits from having grown more and better trees cannot be properly gauged without analysis of alternative investments which might be made in New Brunswick. Even if there is a weakness in the quality of forest management by woodlot owners, a perceived need for increased woodfibre availability in the medium-term and long-term, and a desire to maintain rural social and income structures, it does not automatically follow that more intensive management on woodlots is the best public policy solution.

For example, other ways of expanding timber output may better balance benefits and costs and do more to distribute income fairly in rural areas.[86] As alternatives to increase woodfibre availability in the long-run, one could promote:

- expansion of industrial timberland by draining bogs and reforesting cleared areas, as done in Finland (Holopainen 1981; and Saastamoinen 1982), and to a lesser extent in Sweden (Andreason 1978);
- further intensification of industrial tree farming. With minor exceptions, governments and forest products companies in Canada have only recently intensified forest management; a wide margin remains for increases in silvicultural effort, genetic selection, fertilization, and other management possibilities.

For the "famine" period, it might be possible to

- extend cutting into hitherto untouched areas, of which a few still exist in New Brunswick.

- modify land-use policies and timber-harvesting practices on prime timberland set aside for parks and wilderness to lose less gross woodfibre increment in mature accessible stands to natural mortality (urged strongly in the U.S.A. by Hyde 1980, among others);
- bridge a temporary shortfall of supplies with imports -- despite relatively high transportation costs -- in order to sustain output and employment in the wood-using industry (done currently in Scandinavia); and
- possibly accompany a more active import policy with a major programme to chip and export budworm-salvaged timber before it has totally lost value.

Regardless of the investment or forestry option chosen, progress toward success, whether defined in terms of future incomes or timber harvests, will require monitoring.[87] Timely and precise forest inventory data provide the best intermediate indicator of the development of future timber supplies in response to management activity. Such data have been described by Bickerstaff, Wallace and Evert (1981, p. 119) as an "essential prerequisite for more intensive management." Although currently inadequate, inventory data are undergoing a major upgrading in New Brunswick.

In the absence of adequate inventory information, one is forced to use measurements of management inputs as indicators of future outputs. This highly imperfect approach, which focuses on the areas (or linear distances) covered by various forest management activities, could be significantly improved, however. If reports on cost-shared silviculture were expanded to include estimates of anticipated future harvests for each area with and without treatment, broken down by species, year, and type of treatment, then one could gauge the expected future impacts of these activities fairly precisely. In light of experience, one could begin to compare results with projections on a disaggregated basis, and modify the methodology for making projections accordingly. The results from such an expanded

reporting scheme would still be subject to considerable error, and some silvicultural activity (e.g., thinning-out low-quality fuelwood from mixed-wood stands) would fail to be included. Careful estimation of anticipated benefits and costs, and gradual refinement of these estimates would appear necessary for adequate public accountability in any case.

Envoi

The persistence of the "woodlot problem" elsewhere, despite a wide variety of policy initiatives, demonstrates that no quick, cheap, or certain solutions are likely in New Brunswick. Glascock's assessment (1981, p. 6) of U.S. non-industrial private forestry programmes is apt here, too:

> They have provided help to only a relatively small portion of small private forests ... [and] undeniably had some effect in increasing total wood production, but it is impossible to put a quantitative estimate on either the extent of the increase or the results achieved per unit cost.... Increasing the outputs above those that will occur naturally is very difficult, and efforts in this direction may produce but limited results not worth the public cost.... Confusion about the effectiveness of these programs is due in part to uncertainty about their objectives, several being aimed at least as much at increasing owner incomes as producing more timber.

APPENDIX TO CHAPTER 3

MARKETING TIMBER FROM WOODLOTS: A DIAGRAMMATIC ANALYSIS

Introduction

Because of location and size, New Brunswick's major wood-processing firms possess considerable market power vis-a-vis their suppliers. Marketing boards have negotiated both (delivered) prices and quantities, and excess supplies have resulted. Geographical price-discrimination has been accepted by some boards. Contractors not only are influential on marketing boards, but appear to have market advantages in purchasing stumpage. The market for timberland is highly imperfect,[88] and the market for stumpage from woodlots may be similarly characterized. Prevailing timber "delivery ticket" systems are particular schemes for restricting supply, scheduling deliveries, and coping with the excess quantities which sellers seek to deliver. In parts of the Province, these tickets are controlled by major firms or contractors. To understand the market for timber under these conditions, it is helpful to use diagrams depicting outcomes under varying conditions of market power exercised by wood-processors, contractors and marketing boards.[89]

Thanks to geographical isolation, New Brunswick's wood-processors purchase timber oligopsonistically; and the

greater the degree of isolation, the more oligopsony tends toward monopsony. As is well known, oligopsonistic outcomes are generally not amenable to precise determination. Hence, to focus the analysis, it is assumed that wood-processing firms purchase timber from contractors (haulers) under conditions alternatively of competition or monopsony. These represent limiting cases. As a further possibility, one may assume that monopsonistic wood-processors are able to discriminate among sellers on the basis of distance, paying less for deliveries originating near the delivery point, and more for deliveries from further away. Such price discrimination is possible only under conditions of oligopsony or monopsony.

Similarly, one may distinguish alternative relationships between contractors and woodlot owners; competition and perfect information, or monopsony and market intransparency. In the latter case, contractors can discriminate among owners with respect to price, paying stumpage rates which are not inversely related to variations in harvesting and marketing costs. Again, the actual situation falls between these alternatives. Finally, one may consider situations in which there is (a) no marketing board, (b) a board which sets (or negotiates) prices but not quantities, and (c) a board which negotiates both price and quantity. Rather than examine each of the 27 permutations of these assumptions individually, we employ diagrams in the following sections to derive several propositions regarding the division of revenues among wood-processors, contractors, and woodlot owners under various market conditions. In the final section, we examine the relationship between stumpage rates and delivered prices in the timber market. The analytical conclusions buttress statements in Chapter 3.

Perfect Competition for Buyers, Contractors and Forest Owners

If all participants in the timber market were perfectly competitive, infra-marginal timber producers (owners) would receive rents, i.e., "producer surpluses" (stumpage revenues above the amounts required to induce harvesting as against

holding the land as wilderness) and wood-processing firms would receive "consumer surpluses" (hereafter, "purchaser surpluses" -- benefits to the buyer in excess of the delivered price). Contractors would receive no revenues in excess of the amounts needed to induce them to carry out their function. In the long run, the marginal land harvested would yield just enough stumpage revenue to maintain it in timber production (i.e., make it worthwhile to harvest periodically). In the short-run, stumpage revenues might be below or above this level, leading to harvesting not being carrried out (and possibly property taxes not being paid), or, alternatively, to harvesting and possibly afforestation. Consider Figure A3.1, a simple supply-demand diagram, with the delivered price of timber on the vertical axis, and the quantity on the horizontal axis. The curve DEXD will slope downward to the right for at least two reasons. First, each of the purchasing firms has its own forest land, which it may harvest at increasing cost (given variations in accessibility and quality). At higher delivered prices it will harvest more of its own land and hence demand less from woodlots, and vice-versa. Second, increments in output by the firms can presumably be sold only on more distant and less favourable markets, yielding lower returns. As a result, increments of inputs will only be demanded at lower prices.[90] As demand for processed wood products fluctuates, the derived demand for timber at millgate will also fluctuate. Curve DEXD will therefore shift up or down from time to time.

Curve AA depicts the unit short-run access, logging and delivery costs (referred to below as ALD costs) from various woodlots, arraying these lots from the lowest to the highest cost. If future demand and willingness to cut were irrelevant, this curve would be the supply curve of timber delivered at millgate, and the amount delivered would be OX*. Total ALD costs would equal the trapezoid AXX*O, and stumpage revenue (producer surplus, or rent) would equal the triangle NXA. Together, ALD costs plus stumpage would equal total timber

FIGURE A3.1

A COMPETITIVE TIMBER MARKET

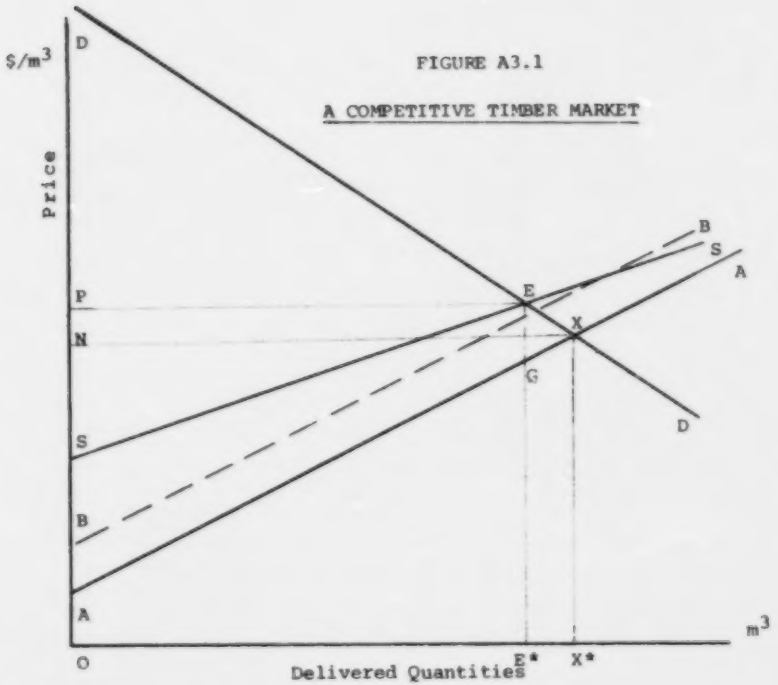
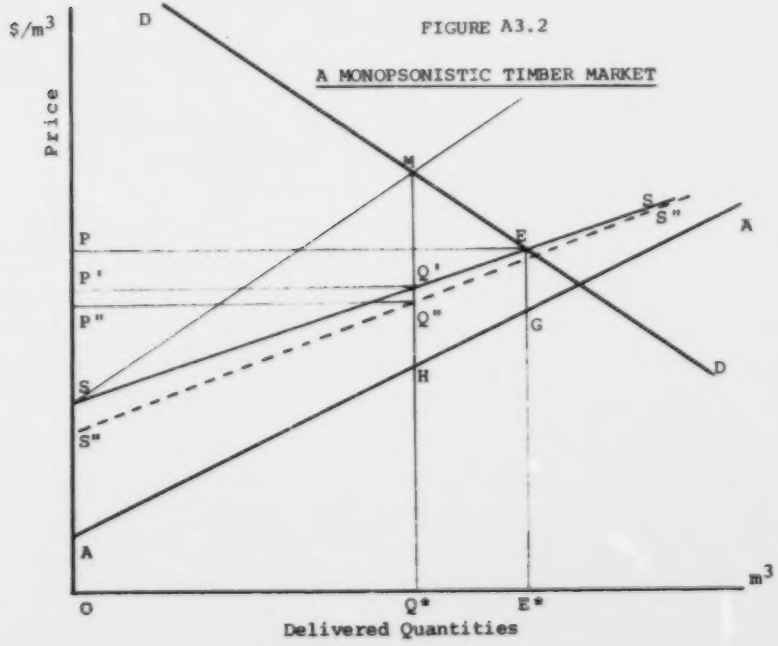


FIGURE A3.2

A MONOPSONISTIC TIMBER MARKET



revenues, i.e., timber sales of OX* times the unit price of ON. In this case, purchaser surplus -- the benefit to the purchasing firms above the amount paid -- would equal the triangle DXN. Thus producer and purchaser surplus together comprise the area AXD, which represents the gross value of the woodlot timber to the wood-processing firms, net of the direct ALD costs.

The difference between curves AA and BB represents the unit stumpage revenue required to keep land in private timber production. (This might simply be conceived as the capitalized value of anticipated property taxes.) To avoid unnecessary complexity, this amount is assumed to be the same for all land. The minimum unit stumpage revenue which would induce woodlot owners to harvest, based on past and current experience, is shown by the difference between curves AA and SES. It is assumed that this is inversely related to ALD costs alone; in reality, this relationship will be complicated by variations in the owners' perceptions of the timber market, susceptibility to persuasion by contractors, and reasons for holding timberland.[91] However, as a first approximation, we may put these complicating factors aside.

Curve SES is therefore the actual supply curve of delivered timber, representing ALD costs plus minimum stumpage revenues required by owners. Its intersection with the demand curve, DEXD, at point E is the short-run market equilibrium, with delivered price equal to OP and quantity equal to OE* on this perfectly competitive market. Purchaser surplus (benefit to wood-processors) equals the triangle DEP (necessarily smaller than DXN), and producer surplus (total stumpage revenue) equals the trapezoid PEGA. Of total stumpage revenue, the area, SEGA, represents the required minimum to induce harvesting, and the triangle, PES, the excess stumpage revenue above the minimum. As shown, stumpage revenue is adequate to keep forested land in timber production, since the equilibrium point, E, lies above the curve, BB.

Clearly, any short-run fluctuation in demand, and a consequent movement of the curve DEXD, will cause the point of equilibrium, E, to shift southwestward or northeastward, with a corresponding shift in price and quantity. A northeastward shift will induce a rise in ALD costs, producer surplus, and purchaser surplus. A southwestward shift would have the opposite effect. With these linear relationships, increases in costs and surpluses would be overproportional to the same degree for both purchaser surplus and excess stumpage; overproportional, but to a lesser degree, for ALD costs, and underproportional for minimum stumpage revenue. Hence, minimum stumpage revenue per unit harvested will decline if demand increases, and vice-versa.

Wood-Processor Monopsony Power

If wood-processing firms are able to exercise market power and behave monopsonistically but loggers, haulers and owners are numerous and operate under perfectly competitive conditions, this will result in a reduction in delivered price and quantity, and a consequent drop in both the sum of producer and purchaser surplus, and total and average ALD costs on woodlots. However, purchaser surplus will rise at the expense of excess stumpage revenue, which falls by a larger amount. Monopsony thus transfers some potential stumpage revenue from sellers to buyers.

Figure A3.2 reproduces the relevant portions of Figure A3.1, but includes as well the marginal outlay curve, SM. The pure monopsonist restricts purchases to OQ* rather than OE*, forcing the price from OP down to OP', and driving out of the market some timber sellers whose ALD costs (plus minimum required stumpage) are high. Purchaser surplus expands from triangle DEP to the larger trapezoid DMQ'P', and woodlot owner stumpage shrinks from trapezoid PEGA to P'Q'HA. None of the required minimum stumpage has been lost to owners who are still harvesting; the reduction in total stumpage has come entirely at the expense of their "excess stumpage" and the

elimination of stumpage revenues to owners who are no longer harvesting. However, given the dependence of minimum stumpage expectations on actual stumpage rates received, curve SQ'ES is likely to be lower under monopsonistic than under competitive market conditions. An example would be S"Q"S" (which has been constructed to yield the same equilibrium quantity). Under these altered supply conditions price will be at OP", and the transfer of producers "rent" to the monopsonistic wood-processors would increase by the amount represented by the rectangle P'Q'Q"P".[92] Note that Q'H must -- and that Q"H may -- exceed EG; this implies that the introduction of monopsony and lowered delivered prices has raised stumpage rates paid on the marginal timberland harvested under the assumptions employed. As drawn, average stumpage earnings of owners will have declined, however.

Monopsonistic Price Discrimination by Wood-Processors

If monopsonistic wood-processors are able to separate loads of delivered timber according to origin, they will be able to pay lower delivered prices for timber from near by than from far away. Monopsony power will be greatest against woodlot owners located near the millgate, who hence have low delivery costs to the monopsonist (and correspondingly higher transport costs to more distant alternative purchasers); it will be least against owners located roughly equidistantly from other potential purchasers. With price discrimination, these differences will be reflected in sharply reduced total stumpage receipts for nearby owners. At the same time, distant producers will get slightly larger receipts to offset any delivery shortfall from near-by producers and to expand inputs.[93] The effect of these arrangements is to shift some timber harvesting from low ALD-cost to high ALD-cost sources, and to capture a significant portion of producer surplus for the price-discriminating monopsonist. Necessary conditions for this result are that (a) supply sources be segregated by the monopsonist, and (b) the elasticities of supply on these

segregated markets differ. A monopsonist will try to segregate markets to the extent that the marginal administrative costs of maintaining separation are less than the net marginal producer surplus gained. To maximize profit, the discriminating monopsonist will equate the incremental outlay on timber in each separate market to the incremental revenue derived from those timber purchases.[94,95]

Figure A3.3 shows the simplest case, in which the market is separated into only two sub-markets. This diagram reproduces supply curve S"Q"S" and demand curve DMD from Figure A3.2. The marginal outlay curve which relates to that supply curve in the absence of price discrimination, S"M, is now explicitly drawn. In general, quantity demanded under price discrimination will equal or exceed that under simple monopsony, because the marginal outlay curve with discrimination will never lie left of S"M, but may over part of its range lie right of it. As shown, the equilibrium quantity is OT*, which is made up of OU* in the near, low-price, market and U*T* from the distant, high-price, market. OT* is slightly greater than OQ*, the equilibrium quantity in the absence of discrimination. Price in the low-price market, U*U, is substantially less than OP", the price which would prevail in the absence of price discrimination, but necessarily somewhat above the supply curve, S"Q"S", over its relevant range. Price in the other sub-market, U*V (or T*T"), is slightly above OP" (or Q*Q"). The extent of producer surplus captured by the monopsonist is equal to the net of the two hatched areas: Area W minus Area Y.

Clearly, if the monopsonist can segregate more than two markets, even larger amounts of producer surplus can be captured. In the limit, under so-called "first-degree" price discrimination, the entire producer surplus would be forfeited to the purchaser, and the quantity purchased would be at about the competitive level, E", shown in Figure 3.3. In this case,

FIGURE A3.3

A MONOPSONISTIC TIMBER MARKET WITH PRICE DISCRIMINATION BASED ON DISTANCE

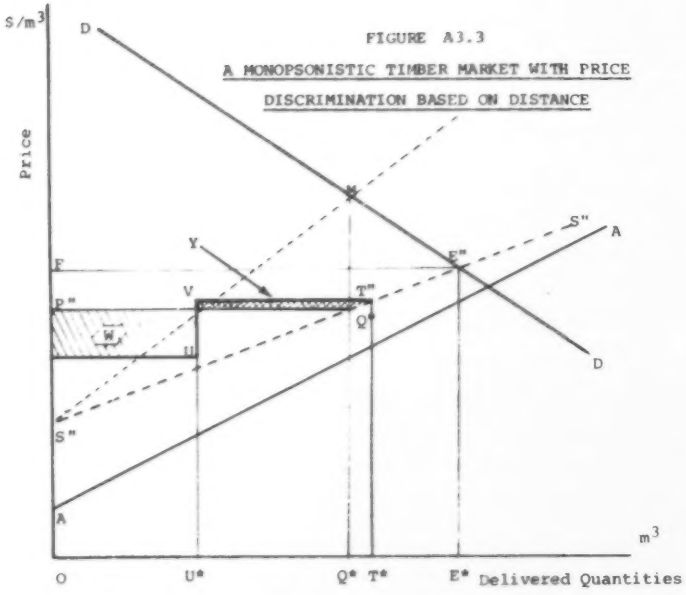
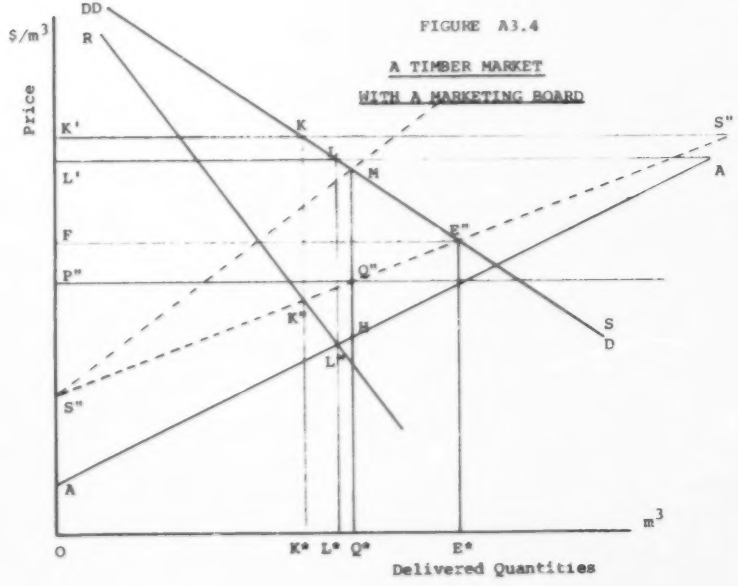


FIGURE A3.4

A TIMBER MARKET WITH A MARKETING BOARD



owners would receive only the minimum required total stumpage, and the per unit stumpage would be minimal. But this theoretically conceivable case will not be approached in practice.[96]

Exercise of Monopsony Power by Contractors

To this point, we have assumed that contractors (i.e., loggers and haulers) could exercise no market power and were all equally efficient. Now suppose that contractors still have no power with respect to wood-processors (who may be competitive, or monopsonistic, and if the latter, may price-discriminate) but are able to negotiate individual stumpage prices with woodlot owners. Furthermore, suppose that there are few contractors and that information regarding stumpage prices is poorly disseminated among owners. In other words, contractors are now assumed to possess market power vis-a-vis owners, but not against wood-processors.

Under these conditions, quantities of timber cut would essentially be unchanged from the three previous diagrams, being determined ultimately by the interaction of wood-processors' demands and the factors embodied in the supply curve, SQES (or S"Q"E"S"). However, contractors will be able to price-discriminate among owners; hence, some of the "excess" stumpage revenue (pure economic rent) received by owners in Figures 3.1, 3.2 or 3.3 will be captured by contractors as excess profits. If contractors had sufficient market power, and entry into logging and hauling could be restricted, returns to owners might be reduced in the limit, as in the previous case, to the trapezoid which reflects minimum required stumpage revenue at various levels of output. Realistically, the market for stumpage will never be completely intransparent, nor will contractors -- in the absence of marketing boards -- possess this much market power; moreover, some owners have the option of doing their own logging and hauling. Hence only a portion of the excess stumpage revenue of owners can be captured by contractors operating under the

assumed conditions. Although the limiting situation under this analysis parallels that for monopsonistic wood-processors, the effects of monopsony power exercised by contractors on returns to owners are likely to be in addition to those resulting from wood-processor behaviour.

Marketing Board Cartel and Perfectly Competitive Timber Buyers

Under the assumptions considered so far, sellers of timber to wood-processors have behaved as perfect competitors, and faced varying degrees of market power. Now suppose that marketing boards are introduced. At the extreme, these boards would enable timber-sellers to behave as a perfect cartel. Let us assume for the moment that the boards face timber purchasers who behave as perfect competitors.

Cartel pricing and behaviour is like that of a monopoly, with one major difference: a monopoly is a single seller, with a single unit controlling production and sales decisions. A cartel is comprised of a number of sellers and decision-making units, who in some fashion are able to make joint sales and production decisions. To be effective, a cartel must be able to enforce these collective decisions on its members, each of whom would stand to gain by exceeding its share of production and sales. In addition, a powerful cartel (like a powerful union) may have the option of excluding some potential sellers, thus improving the market prospects for those included.

If it fully exploits its market power, a cartel will attempt to raise prices until its marginal revenues just equal its incremental cost of supply. This implies a transfer of purchaser (wood-processor) surplus to the cartel. (A cartel may also seek to fix delivered quantities; fixing both price and quantity will be possible only if it is faced with a monopsonistic buyer with whom it can negotiate. We take up this possibility in the next subsection.) Figure A3.4 reproduces the relevant supply and demand curves from Figures A3.1 and A3.2. In addition, the diagram indicates the marginal revenue curve, RK"L"R, which would face the cartel if

wood-processors were perfect competitors. This intersects S"E"S" at K", and AA at L". Depending on which of these latter two is regarded as the supply curve (see below), the cartel will seek to price at OK' or OL' respectively. Compared to the initial competitive situation (equilibrium price at OF, quantity at OE*), this will mean reduced quantities sold and an excess supply ranging up to KS", since individual sellers in the cartel will want to deliver more wood at the new higher prices than buyers will purchase. An inevitable result is that the cartel must find some means of limiting or rationing timber supply in order to enjoy the expanded level of "surplus" it secures from buyers through price-fixing. Furthermore, it may have problems dividing this surplus "equitably" among its members.[97]

Marketing Board Cartel and Monopsony: Price Bargaining Only

Now change the assumption of perfect competition in timber purchasing to monopsony power. With no marketing board, the equilibrium price and quantity would be OP" and OQ*, respectively. With a marketing board cartel, the situation is one of bilateral monopoly, and bargaining should result in a negotiated price somewhere in the range OP" to OK'. Should the monopsonist price-discriminate with respect to distance, as discussed earlier, the cartel may negotiate a structure of prices between U*U (not shown in Figure A3.4) and OK' which preserves some measure of discrimination based on distance. Depending on relative bargaining strengths, three outcomes relative to the equilibrium depicted in Figure A3.3 are possible:

a. at a negotiated price (in the high-price market) below OF, equilbrium price and quantity will both rise, and there will be no excess supply. The competitive situation analyzed in the first section will be approached, and a portion of the monopsony gains reversed.

b. at a negotiated price (in the high-price market)

between OF and Q*M, equilibrium price and quantity will both rise, but there will be excess supply. Total surplus will increase, and there will be a major transfer of surplus from buyers (wood-processors) to sellers.

c. at a negotiated price (in the high-price market) above Q*M, quantity sold will shrink, and there will be a major problem of excess supply -- as in the initially competitive situation analysed above. Total surplus will fall, since it is quantity-dependent, but surplus accruing to sellers will rise.

Given the relative experience and financial strength of monopsonist and cartel in New Brunswick, outcome (a) is most likely, and outcome (c) improbable. Thus timber sellers are likely to secure both higher prices and sales volumes at the expense of wood-processors' profits.

Whether AA or S"E"S" is treated as the cartel's average cost curve depends on who controls the cartel. If controlled by contractors, required minimum stumpage will be a cost of supply. Thus, a reasonable goal of "contractor power" would be to attempt to maximize excess stumpage revenue, while diverting it to the contractors. A fall in acreage harvested because of cartelization is likely to be of little concern. Contractors will seek to use the cartel not only to secure a portion of purchaser surplus from wood-processors, but also to exercise market power vis-a-vis woodlot owners. Even if output should expand, minimum required stumpage revenues per unit of timber harvested will decline; hence average stumpage revenue received by owners might well drop. Marketing boards may provide the mechanism for establishing contractor monopsony.

Control of the cartel by woodlot owners, on the other hand, is inconsistent with full exercise of market power by contractors; if such "contractor-power" existed before cartelization, it presumably would be attenuated. For woodlot owners, only ALD costs are true costs of supply; hence, if they control the cartel, AA is the appropriate supply curve.

Furthermore, owners are likely to be more sensitive to preventing some of their number from harvesting, and hence less willing to push prices up at the expense of reducing the quantity harvested. For both these reasons, in contrast to contractor control, owner control implies larger quantities harvested, reduced amounts of supply in relation to demand, and greater stumpage revenues -- both per unit and overall.

Marketing Cartel and Monopsony: Price and Quantity Bargaining

As a further possibility, consider negotiations between a marketing board and a monopsonist to fix price and quantity together. This opens up a somewhat wider range of outcomes, because so-called "all-or-nothing" contracts become possible, under which a portion of the weaker party's surplus may be forfeited to the stronger party. This type of negotiating and contracting could conceivably yield a result similar to "first degree" price discrimination. Furthermore, markets need not necessarily clear. Combinations of prices between OK' and OP" and quantities between OK* and OE* are possible. Any price/quantity combination above the supply curve, S"E"S" in Figure A3.4, will result in excess supply relative to demand at that price, hence necessitating a system to restrict supply. Any price/quantity combination below the S"E"S" curve may lead to failure to deliver by the marketing board, an elaborate type of supply-control system such as described in the previous paragraph, or at least the necessity for the marketing board to hold inventories so that temporary sales fluctuations above levels which owners are willing to harvest can be accommodated. Aside from these considerations, the results of negotiating both quantity and price are similar to those outlined in the previous section.

Effect of Changes in Demand on Stumpage Rates

An increase in demand by wood-processing firms which results from increases in the cost of alternative sources of supply (e.g., Crown timber) or reductions in their

accessibility will shift the demand curve and each of the points on it, K, L, M, E", northeastward, if elasticities of demand remain constant. Assuming no accompanying changes in marketing board powers, price discrimination, or ownership behaviour, the result will be an unambiguous increase in seller power and an increase in quantity, delivered price, or both. If the elasticity of demand for woodlot timber is reduced -- as appears to be mandated by the Crown Lands and Forests Act (vide Chapter 4) -- the same conclusions hold, but with greater force, except with respect to increases in quantity.

Total stumpage revenue must rise under these conditions, regardless of market structure, but stumpage per unit harvested may rise or fall, and excess supply may also decrease or increase. A substantial quantity increase accompanied by little or no price increase will cause a fall in excess supply -- if any -- as well as per unit stumpage rates. A significant price rise together with a modest quantity increase, will necessarily raise excess supply, and -- in the absence of price discrimination and contractor power -- per unit stumpage must rise too.[98]

Conclusion

It would be a mistake to interpret the results of the foregoing analysis too rigidly. Notwithstanding the complexity of the diagrams, they fail to capture the full flavour of the actual market. Hence, tendencies or limits are indicated, rather than precise outcomes. Nevertheless, available anecdotal evidence regarding the functioning of the timber market in New Brunswick is consistent with the general conclusions which appear warranted on the basis of the deductive analysis in this appendix:

- the link between delivered timber prices and average stumpage rates is not direct;
- some potential stumpage revenues of woodlot owners are being diverted to wood-processors and contractors;
- marketing boards offer contractors the potential for

signi[illegible]nt gains in income and security; and

- unless a marketing board is completely dominated by contractors, its marketing activities appear likely to improve the revenues of woodlot owners as a group.

NOTES

Chapter 1

1. Definitions of merchantability vary by species and by province. Generally only trees with a minimum diameter of three to four inches at breast height are included. Stump, top, and branches may be excluded. Defective or decayed wood in the main stem may be included. Volume statistics are based in part on sampling and involve a considerable element of judgement. See Bowen (1978, p. 5). A further element of judgement enters in determining "economic accessibility" (Bowen 1978, Statscan 1982: 25-202, and Reed & Associates 1978) or economic "operability class" (Bickerstaff, Wallace and Evert 1981).

2. The recent Provincial forest inventory (N.B., DNR-FMB 1981) reveals a sharp decrease in the proportions of spruce and fir wood volume in New Brunswick to 53%.

3. In the period 1976 through 1980, Statscan's harvest estimates (including fuelwood) range from 139 to 162 million cubic metres. Other average estimates for periods in the recent past: 156 million cubic metres harvest (Reed 1978, Table 25); 131 million cubic metres harvest and 10 million cubic metres fire loss (Bowen 1978, Tables A31 and A32); and 128 million cubic metres harvest, and 25 million cubic metres fire loss (Bickerstaff, Wallace and Evert 1981, Tables 37 and 38).

4. Bickerstaff, Wallace and Evert's (1981, Table 38) estimate for operability class 1 alone is 211 million cubic metres; including operability class 2 raises this value to 407 million cubic metres. Regarding this as optimistic, they

reduce it by one quarter to about 300 million cubic metres. See particularly their chapter 7 and Appendix IV by G.H.D. Bedell which includes an estimate from 1964 equivalent to 285 million cubic metres annual growth.

5. The age-structure problem is considerably more acute on industrial holdings in New Brunswick than on woodlots, however. Of lands with softwood cover, 76% of Crown acreage carries trees 60 years or older, and there is virtually no acreage with trees aged 30 to 60; on woodlots, only a sixth of the acreage carries trees over 60 years old. (N.B. P.W.R.S. 1983, p. 54)

6. This annual reserve is the additional accessible amount of timber which could be cut annually without running down the forest inventory in quantitative terms.

7. Skok and Risbrudt (1982, p. 18) show a modest drop in real delivered spruce/fir pulpwood prices in New England from 1950 to 1980 and a one-third decrease in stumpage prices. Although no New England areas are included in their survey of sawlog data, eastern softwood sawlog delivered prices rose over the same period by 150%.

8. On a non-declining sustained yield basis, there is insufficient woodfibre to permit full-capacity operation of the Province's wood-using industry at the present time. The sustained yield concept is explained in the next chapter, and the problem discussed in more detail in Chapter 4.

9. Report of the Select Committee on Renewable Resources (N.B., Legislature 1981, p. 4). See also O'Neill 1979, pp. 22-23. In the words of New Brunswick's leading forest supply expert:

> Every [forest] stand that will mature in the next forty years in New Brunswick is already committed for use in some processing plant.... We will be unable to harvest stands of the present quality classes for pulp and saw-logs in all portions of the Province over the next forty years.... Beyond that all is roses as our extensive managed stands will by then be coming on line.
>
> There is not much uncertainty in the above forecast.... The harvest of the present 60 year old forest must be extended over a time period sufficiently long to allow the stands on cut-overs from the early 1950's to reach a size suitable for harvest.... Our current levels of management and improved utilization, should allow us to just maintain our industry through a critical period

> some fifteen to twenty-five years from now, although with some reduction in quality of raw material. Any loss of growing stock from the older age class, as a result of spruce budworm caused mortality, will shorten the liquidation period of that mature forest, and enhance the severity of the shortage problem. Similarly, budworm defoliation of the younger forest, which results in a reduction of the growth rate, will lengthen the time for it to replace the older forest, and thereby also enhance the severity of the shortage problem.
>
> (Baskerville 1981, pp.55-56; emphasis his)

10. These potential imbalances between demand and supply were perceived ever more sharply in the 1970's as forest inventory information was updated and analytical capabilities in the Province's Department of Natural Resources were improved. At the same time, budworm losses exceeded expectations, while simultaneously the paper and pulp industry expanded significantly (Watson 1983, pp. 4-6).

Chapter 2

11. Volume measures may be gross or net of decayed and defective wood, as well as of unusable species and culls. Biomass and pulpwood volume may refer solely to the stem or bole of trees, or include stump, top and branches as well. Merchantability has various definitions which vary by province, species, and anticipated utilization. For expository purposes these distinctions are immaterial. The meaning of "even-aged" is elucidated below.

12. Site quality is not a uniquely defined concept but will vary with the species being considered. "Normal" yield tables are for fully-stocked stands; "empirical" tables are for stands with average stocking. Some yield tables are on a variable density basis as well.

13. For empirical detail, see Field (1982b); for analysis of optimal behaviour in terms of value rather than volume yields, see inter alia Jackson (1980) and Heaps (1981).

14. Note that this may be either earlier or later than the biological optimum. Taking account of future crops, one must substitute for i, the interest rate, the expression

$$i/(1 - (1+i)^{-n}).$$

This latter expression is the annualized worth of uniform interest receipts over a period of n years, where n is

the length of anticipated future rotations. Its value will be about one percentage point higher than i for low rates of interest and periods of about 50 years.

15. A few trees might be of a different age from the remainder in a given stand; for example, seed trees might be present on acreage devoted to seedlings, or advance regeneration might naturally occur in a stand comprised primarily of mature trees.

16. In this model forest, there is no site variability among hectares and no genetic improvement or degradation in tree quality over time.

17. On the many woodlots with severe budworm damage, even-aged regulation may be the only sensible option.

18. No value judgement is implied. The "normal" forest is essentially a model developed by German foresters in the 19th century to suit Western European circumstances (Hyde 1980, pp. 194-202).

19. In Page's formulation (1977, ch. 8), the conservationist criterion involves a crucial implicit assumption: that substitutability among resources and investments is excluded. In other words, it is deemed that the value of excess timber inventories cannot be transformed into more productive forms of capital, as postulated by Bickerstaff, Wallace and Evert (1981).

Chapter 3

20. According to Roy's Survey (1983, Table 28), about 40% of woodlot products are sold on a delivered basis, 25% at roadside, and 30% as stumpage. These percentages vary greatly in different parts of the Province (e.g., 70% in Madawaska versus 16% in southeastern New Brunswick sold on a delivered basis). Knowledgeable persons on marketing boards indicate, however, that 80% to 90% of woodlot products are delivered by contractors. These latter percentages are consistent with the previous values only if a very high proportion of those who responded to the Survey are contractors as well as owners.

21. Stumpage is sometimes for the entire harvested volume from a woodlot, or alternatively on the basis of unit prices applied to measured or "scaled" volumes by species and quality.

22. This description abstracts from exports and imports of timber and chips. Amounts bought and sold extra-provincially by Provincially-based wood-processors

are shown in Table 3.1. However, unknown quantities of timber are also exported directly from woodlots in the western part of New Brunswick, sometimes with the intermediation of wood brokers.

23. One should approach these data with caution. First, the division between large and small private freeholds differs in the inventory and the utilization data, and in any event is imperfect. Wood-processing firms may own isolated parcels or cutting rights thereon. Land sales may not be registered, and beneficial ownership is sometimes unclear. Second, volume data relate to 1979, while harvest data are averaged for 1977-1981, but include only wood cut and processed in New Brunswick. Hence, fuelwood and exports to Maine and Quebec are excluded. Probably updated data would reveal even greater disproportions resulting from recent heavy cutting and budworm damage on the woodlot resource.

24. A similar picture of average woodlot size emerges from the New Brunswick Nonindustrial Private Woodlot Owner Survey (Roy 1983). Its average holding is about 132 acres rather than 93 acres, a difference which is more than explained by multiple holdings (which are excluded from the values in the text which are based on tax lists). Note that less than three-quarters (3.6 million acres out of 5.06 million acres) of the woodlot acreage is accounted for in Table 3.3. However, Roy (1983, Appendix III) also leaves 15% of the acreage (800,000 acres) unaccounted for, probably because holdings under 20 acres are excluded.

25. A few licensees simultaneously are sub-licensees of another major firm. Typically, these dual-role firms are capable of processing timber species not required by the licensee.

26. Some sub-licensees continue to contract directly with landowners without the intervention of marketing boards, although the latter could legally control these transactions. However, sales of cutting rights do not appear to be generally subject to marketing board control. Hence, such sales, or outright sales of timbered woodlots, permit individual owners and wood-processors to evade marketing board controls.

27. Non-residents are explicitly excluded in the south and southeast and implicitly in the other five marketing board areas, where elections of board members are indirect. In these five areas, participants in each parish elect a delegate to the annual meeting of delegates. There, the board members for the coming year are chosen.

28. Despite both ownership and "production" requirements, unintegrated woodlot owners face a similar situation under the marketing board regulations in the Northumberland area

and on the North Shore because "production" is not defined. Clearly, if interpreted to mean harvesting, a contractor who had purchased cutting rights to 25 acres somewhere in the Province would qualify under both the ownership and "production" provisions.

29. The analysis is concerned with the short-run cutting decision. An owner who maintains a woodlot for purposes other than timber production will also be influenced by listed factors, but his reluctance to cut will presumably be greater.

30. It is important to be clear on this point. As any good elementary economics text will explain, the value of the land in question depends on anticipated prices of lumber and pulp and the quantities of these products which the land can yield over time, not vice-versa. The economic rent (and the stumpage) on good forest sites far exceeds that on poor sites. The bare land value of the marginal site harvested -- the least favourable site where harvesting is worthwhile -- theoretically will equal zero.

31. Both contractor and owner face trade-offs of greater current revenue against foregone future timber output. But for the former, the likelihood of harvesting the same lot in the future is lower and hence the optimal trade-off more favourable to current revenue than for the owner. Furthermore, the contractor faces large fixed costs for his equipment, and hence will be strongly oriented to the short-run.

32. Distribution of tickets may be done either directly by the firm or the appropriate marketing board, or split between them. In some cases, tickets are distributed to contractors or haulers; in other cases to owners; and in parts of the Province, some tickets go to contractors and owners jointly. There is a market for tickets, and sales and exchanges occur, but, for obvious reasons, informants were reluctant to discuss this inevitable development.

33. In one marketing board area, for example, two contractors are said to have received half the tickets, giving them great market power.

Chapter 4

34. As noted in the previous chapter, some licensees are also sub-licensees of other major firms, thus obtaining a portion of their requirements from areas managed by another licensee.

35. However, access and delivery costs from marginal Crown

acreage would have been higher than from marginal woodlot acreage, and tenure on Crown lands subject to uncertainty in recent years.

36. The coefficients of variation for Crown land, large freeholds, small freeholds, and overall are, respectively, 14.0%, 8.6%, 10.2% and 8.9%. This means that in approximately one year in three the amount of fluctuation in output will be larger than the percentage indicated. Remember that these percentages relate to changes in aggregates; because of offsetting fluctuations, the degree of variation in output for individual industrial holdings would have been significantly greater. (Data relating to the private holdings must be interpreted with some caution because some industrial timber output seems to be generated by small freeholds.)

37. Indeed, redivision may occur at even shorter intervals. Paragraphs 12(3) and 12(4) of the standard forest management agreement (FMA) provide that any unutilized portion of the maximum annual allowable allocation of a sub-licensee in any year be made available to the licensee, and that any unutilized portion of the licensee's annual allowable allocation below 90% in any year may be forfeited without compensation to the Crown. Since a Crown licensee may simultaneously be a sub-licensee of another licensee, a forfeited allocation may be turned over to another firm without a change in license boundaries.

38. Consider an example derived from the Background Report to the Minister. Take a firm with a total (full-capacity) requirement of 250,000 cords of cordwood, 70,000 cords (28%) of which is to come from woodlots. If its Crown dependence is 105,000 cords, it will have received 71.6% of this, 75,180 cords, as its Crown allocation, and will be able to sustain a throughput of 220,180 cords. The Ministerial formula calls for a firm operating at capacity to accept ten percent in excess of the 70,000 cords from woodlots (i.e., 77,000 cords); and if operating below capacity, a proportionately reduced amount. Suppose actual demand is 82%, 80%, or 75% (205,000, 200,000, or 187,500 cords) respectively of full capacity. Then, under the Ministerial formula, guaranteed woodlot supply will be cut back potentially 18%, 20%, or 25% respectively, and will equal 28% of actual demand (57,400, 56,000, or 52,500 cords) plus up to 10% more in any year. Non-woodlot supply will be at least 141,860, 138,400, or 129,750 cords respectively, equalling 94.5%, 92.2%, or 86.4% respectively of the total non-woodlot allocated supply of 150,180 cords. Thus the supply cutbacks from large freeholds and Crown land would range from 5.5% to 13.6% at a maximum, while those from woodlots would be 9.8% to 17.5% at a minimum.

39. By way of exception, FMA Paragraph 12(5) does state that a forest management agreement is not violated if a licensee cannot meet the foregoing restrictions "due to conditions beyond [his] control ... includ[ing] adverse market conditions ..." The plus-or-minus five percent limitation over five years is the binding constraint.

40. The harvest fluctuations discussed relate to periods of one to five years or longer. Variations in harvesting and deliveries also arise within a single year. Changing weather conditions cause variations throughout the year in the cost of delivering timber to wood-processing facilities. The law and regulations provide a check on deliveries only once a year; wood-processors could hurt haulers, loggers, and ultimately woodlot owners by imposing substantial seasonal fluctuations in deliveries from small holdings. Some industry participants suggested that this had indeed happened, that some firms were getting a disproportionate share of supply from Crown land during the low-cost season. Surely delivery schedules between licensees and marketing boards could be fixed three to six months in advance, revised monthly and monitored more frequently.

41. The survey classified incomes above $5000 into three intervals of $10,000 and an open-ended class above $35,000. Using the mid-points of the closed intervals, and $40,000 for the top class, an average of $19,032 results for the 87.3% who responded to this question. If the top class is assumed to have an income of $45,000, an average of $19,822 results. In 1979, median post-tax income of families and unattached individuals in non-metropolitan parts of New Brunswick was $12,966 and income tax was estimated at $1726, for a total of $14,692 (Statscan 1982 (13-210), Table 20). (In urban areas of the Province the corresponding pre-tax income was $2,100 higher.) Data for 1981 is aggregated for the Atlantic area, and shows a 12% increase over 1979 (Statscan 1983 (13-210), Table 16). The $18,400 figure in the text for 1981 results from incrementing the 1979 figure by 25% to take account of the annual increase at 12%. Average per capita income in New Brunswick would have been under $8000 in 1981 (Statscan 1982 (13-213)).

42. Calculated from data in Table 1.2 above. Incrementing this value by 12% to adjust it to a 1981 base yields an average income of $18,000.

43. Some woodlot owners may live in cities -- although that is irrelevant to the employment and income prospects of rural dwellers employed in the logging industry. Furthermore, these figures may be subject to biases and underreporting. But such qualifications are unlikely to change the

conclusions in the text. Indeed, woodlot owners, being clearly in possession of assets, will generally be wealthier than average rural dwellers, as well as having somewhat higher incomes. What proportion of commercial harvesting from woodlots is carried out by contractors is unclear: 60% to 80% are values suggested by well-informed observers; however, Roy's Nonindustrial Private Woodlot Owner Survey (1983) yields values lower than 30%, apparently because cutting firewood for personal use was not separated from other harvesting on the questionnaire.

44. This problem has a further dimension. There is a widespread perception that many potential sawlogs from private woodlots are still ground up for pulp. This was one of the problems which it was hoped the CLFA might rectify. Although sawlogs have a considerably higher value per volume than pulpwood, to separate them from the bulk of the harvest requires an expenditure of effort on the part of the contractor which may not be financially rewarding, particularly if the proportion of sawlogs is low. Given systematic differences in the supervision of cutting practices as between woodlots and other timber operations, it is likely that failure to separate sawlogs is most severe on woodlots cut by outside contractors and least severe on woodlots cut by the owner.

45. Woodlots harvest and sell 25% to 30% of the total volume processed in the Province (Table 4.1). Of this amount, a third to two-thirds (see note 10) is sold as stumpage, with the rest being sold either at roadside or delivered by the owner. About half of stumpage sales are thought to be on a lump-sum basis, e.g., a fixed sum for the total volume of timber on an entire lot. Hence, stumpage sales on a per-unit basis are probably no more than ten percent of the total harvest.

46. For these hardwood products, Woodlot Service (1982a) indicates an average price of $4.20 per cord in 1981 and of $8 per cord (1982b) in 1982.

47. The weighted average value was nearly $4.00 per cubic metre. A number of these "overheads" appear not related to the unit value of standing timber to be harvested, but instead to be overheads of harvesting or of growing. Double-counting is involved in the first case, since harvesting charges will again recover these costs; in the second situation, today's sub-licensees are now paying costs which may benefit some other sub-licensee two or three decades hence. Large variations among licensees in these overhead charges in 1982 (= $1.55) were greatly reduced in 1983 (= .83). Uncertainty about which overheads could legitimately be charged may have accounted for some of the variations.

Chapter 5

48. Jaakko Pøyry & Associates (1978) point out, however, that the harvest has generally run well below AAC in both Sweden and Finland in recent years. Below-capacity operations are partly responsible, but Finland, in particular, has also imported significant timber volumes.

49. From a political point of view, industrial wood-fibre users have an interest in identifying future shortfalls of timber supply and fixing responsibility on woodlot owners. Not only does this divert attention from any deficiencies in their own management efforts, but it may promote public subsidies to timber-growing which will ensure future supplies and ultimately reduce raw material costs.

50. Rising nominal stumpage prices which are simply part of general inflation will clearly have no immediate effect on forest management, since silvicultural options will increase by the same proportion. Indirectly, there may be some negative influence as forest land is purchased as an inflation hedge, thus driving up its relative price and lowering the real rates of return to forest management (Raup 1978, pp. 112-113).

51. In New England, a significant private forestry consulting sector has also developed in recent years.

52. Some informants made negative comments about deliveries, cost, and availability of desired species of seedlings from the Provincial nursery, but whether these reflected an isolated or a general problem is unknown. In parts of the Province there is a fifteen-fold disproportion on an acreage basis between the numbers of government foresters supervising Crown lands managed under license by major forest companies and the numbers of government forestry extension workers.

53. An exception is Madigan and Jones (1981), but their apparently non-random survey of 4000 rural dwellers in four provinces resulted in only 265 responses, a response rate of only one in fifteen.

54. Most surveys of forest owners inquired only about the primary motive for land holding. Roughly a quarter of owners in New Brunswick regard timber production as a secondary or tertiary motive. (Roy 1983, Table 25)

55. However, these activities are preconditions to forest management. Note that of the silvicultural activities carried out in southern Ontario, only a fifth derived from an intent to grow more wood for sale.

56. Mills and Cain (1978) assume 100% retention of treated stands and 100% implementation of subsequent treatments as needed. In most cases, they also assumed no merchantable output for unmanaged northern conifer stands (p. 8).

57. Elsewhere (p. v), the same document points to "higher interest costs on borrowed or investment money than can be recovered from investments in forestry, unacceptable time lags between investment and returns, lack of liquidity, and burdensome tax laws."

58. According to Popovich (1978), William Sizemore, author of an oft-cited major consulting study, "Improving the productivity of non-industrial private woodlands" (1973), did not invest in management on his own timberlands because of low returns. Vardaman (1978), an experienced forestry consultant in the southern United States, has indicated that expensive site preparation and planting do not pay.

59. Deemed realization of capital gains under the Income Tax Act at death seems likely to lead increasingly to estates having to liquidate timber inventories in order to pay the capital gains tax due.

60. In the most northeasterly state examined, Pennsylvania, less than a third of the cases required no attention and half either did not warrant retention or had not been retained. In the entire sample (and in Pennsylvania), ownership had changed in slightly less than 30% of the cases.

61. No insect is more destructive of commercial forest values than the spruce budworm (Rose and Lindquist 1977, Irland 1980, and Munro 1982). MacLean (1980, p. 215) pointed out that Tothill's (1921) estimate of five million cords killed in New Brunswick from 1914 to 1921 "was equivalent to 75% of the merchantable fir ... in the area." MacLean and Erdle (1984) simulate a 46% to 64% drop in sustained yield from a severe budworm outbreak. This confirms the 50% harvest reduction estimated in the Baskerville report (New Brunswick, Cabinet Committee on Economic Development 1976).

62. The harvest decision is obviously contingent on there being a market for the timber. Since demand, timber prices and markets are positively correlated, this condition is likely met in the scenarios discussed. Note that the extent of the harvest and the care with which it is carried out (vide Chapter 2) also depend on the parameters mentioned in the text.

63. There is no change in the percentage growth rate of the gross value of a forest holding, but since harvesting, hauling and silvicultural costs are assumed unchanged, the

percentage growth rate of net value will necessarily decrease somewhat. Using alternative plausible production functions, Jackson (1980, p.21 and p.27) shows that optimum harvesting may be accelerated or retarded by a once for all price increase.

64. Joseph, Irland and Howard (1979) includes graphs of average annual stumpage prices by species and utilization for a recent twenty-year period for Maine. Real pulpwood stumpage prices there show little interannual fluctuation and a slight long-term trend downward.

65. For those forest owners who do have timber production as a primary goal, forest management may be equal or superior to that practiced on industrial holdings.

66. In fact, as noted in Chapter 1, Adams et al. (1982) project a considerably less optimistic stumpage price scenario in the United States. If realized, this would have a major negative impact on pulpwood stumpage prices in Eastern Canada in 30 to 50 years.

Chapter 6

67. There is a vast literature. See, inter alia, Reed (1978); Ontario, MNR (1982); Stoddard (1961); Harou (1981); Commission of the European Communities (1979); and Irland (1982d). On individual countries, see Stjernquist (1973); Palosuo (1982); Holopainen (1981); Zivnuska (1959); Norway, Det Kongelige Landbruksdepartement (1982); and Oedekoven (1981).

68. In addition to the references in the previous note, see Puttock (1982), Madigan and Jones (1980), Meeks (1982), Plochmann (1974), and UN, FAO (1979).

69. See, notably, Mills and Cain (1979), Risbrudt and Ellefson (1982), and Fitzsimmons and Harou (1982), and Field (1982a).

70. Natural, marketing, and political risks are involved. Aside from normal small-scale protection measures (e.g., fire ponds), avoidance of monoculture is one of the few possibilities open to woodlot owners for reduction of natural and marketing risks.

71. People vote, not trees. Since woodlots vary greatly in size, subsidies to timber growing and to timber growers are neither politically nor economically identical.

72. The regulations of the Madawaska Board offer a good model.

73. This involves the commitment of one dollar per cord to woodlot management, usable in the first two years only by the woodlot owner from whom the wood has been cut. Given the length of the crop cycle, two years appears to be an unduly short period.

74. See Roy (1983, p.75) for data on woodlot owners' ages. Probably about 80% of all woodlot acreage is affected by both considerations together.

75. 50% deductibility applies to losses over $2500, but less than $7500. A carry-back of one year and carry-forward of five years is permitted, but only against hobby farm income. Given the duration of the forestry crop cycle, these provisions do not help much.

76. Note that "forest classification" and penalties for "declassification" relate to specific acreages; hence they apply to subsequent as well as current owners.

77. It would also be advantageous to have a pricing policy which would encourage woodlot owners to plant fast-growing species.

78. In the long-term, "budworm" silviculture -- planting resistant species and thinning out fir -- may reduce the risk of major devastation of future woodlot investments by this destructive insect. However, this is a disputed issue.

79. Forcing pulpmills to accept "grey" deliveries along with "green" ones, and issuing corresponding "coloured" tickets to contractors might increase utilization of salvage. However, strong disincentives to handle salvaged wood affect most industry participants, so this suggestion would be difficult to implement.

80. Interestingly, Forestry, the recent report of the Nova Scotia Royal Commission on Forestry (N.S., R.C.F. 1984) recommends cutting back the powers of the Nova Scotian Pulpwood Marketing Board, restricting it in the immediate future "exclusively to the registration of bargaining agents," and subjecting it to review with a view to its possible abolition.

81. As an example of a credit-granting arrangement, consider the Forestry Credit Act in Quebec (Gendreau and Mignault 1981). The Study's Report does suggest a low interest loan programme to assist woodlot owners to acquire up to 1000 acres of additional woodland for managed commercial timber production.

82. Although relatively little Provincial forestland is

involved, it might be politically attractive to require non-resident owners of holdings in excess of some minimum size, say 25 acres, either to commence on-going management within five years or lease to the Trust. This would create a pilot-project situation in which the success of the Trust concept could be demonstrated to residents. Nevertheless, discriminatory laws directed at non-resident forest owners should be approached with caution. Many New Brunswickers own lands in adjacent jurisdictions; ill-considered legislation would invite retaliation, which would not be in the Provincial interest.

83. In other words, even with maximum silvicultural effort, the increase in sustainable yield per acre on the non-industrial forest resource would be only one third that on the industrial resource. Even this is optimistic with respect to results on woodlots, since the calculation is based on the assumptions that no non-industrial timber is withheld from market on maturity and that non-industrial holdings are managed on a consolidated basis in the various regions of the Province. Note that species improvement, site improvement, stand establishment, and genetic improvement all require more than 35 years to yield results; only stand improvement, protection, and fertilization can yield results within the next 30 years.

84. The theoretical ideal is maximization of the value of the stream of net benefits, discounted at the social discount rate.

85. For a careful outline of four cost-benefit measures in a forestry context, see Kronrad and Harou 1982.

86. Employment and income in the processing sector are relatively insensitive to the source of timber supply; efficiency in woodland operations is the key determinant of income generated from growing timber. Note that incomes of woodlot owners are somewhat higher than those employed in logging, most of whom live in rural areas.

87. As noted several times, projections or realization of improved quality or quantity of forest inventory at some intermediate stage before harvesting, essential though it may be to ultimate success, does not guarantee it: forested land can be converted to non-forest uses, reserved as wilderness or harvested by wind, fire or insects, rather than man.

Appendix

88. Several observers mentioned purchases of woodlands at less than the current value of the standing timber.

89. This approach to the analysis of pulpwood markets has some similarity to that of Lowry and Winfrey (1974), but involves no assumption of kinkiness (which now, in any event, is in disrepute). Mead's (1977) study of oligopsony among lumber firms bidding for Douglas fir cutting rights in U. S. Federal timber auctions, is, on the other hand, quite unrelated, since it focuses on a totally different institutional structure, as well as a different product and input market.

90. The argument is not affected by drawing the curves as straight lines. Note that purchaser "surplus" -- as is clear from the derivation of input demand -- does not reflect excess benefit in the same sense as consumer surplus mirrors excess utility. Indeed, some purchaser surplus may be essential for the competitive health of firms operating in New Brunswick to compensate for greater distances to market and higher costs of industrial wood supply.

91. The assumption of an inverse relationship between ALD costs and stumpage is realistic, but significantly influences the analytical results below. There will be stochastic variations in this relationship, but these do not affect the argument. Bear in mind also that perceptions of minimum required stumpage are conditioned by actual stumpage revenues received on similar woodlots. Thus these perceptions are not independent of the actual imperfections which may characterize the timber market.

92. If SQES (or S"Q"E"S") is not a straight line, but is convex upward (i.e., required minimum stumpage is relatively more important compared to excess stumpage), the impact of monopsony on quantity and price, as well as on the transfer of surplus to the monopsonist, is reduced. If SQES is convex downward, the impact is increased.

93. Since price in the low-price market is fixed, the marginal outlay curve relating to alternative prices in the high-price market (not shown) will be below S"M, leading the wood-processing firm to operate at a higher input level. In other words, the optimum throughput level is higher, given an assured low-cost supply for part of total input.

94. Let I represent the number of separated sub-markets. Then the condition for profit maximization is that:

$$\text{marginal revenue product} = \text{marginal outlay}_i;\ i = 1, I$$

95. For an introduction to the extensive literature on price discrimination, see Phlips (1983). Little of this

literature deals with monopsony behaviour, however.

96. For the marginal outlay curve to coincide with the supply curve S"Q"S", not only would all the variation in supply have to arise from distance to millgate, access and logging costs being the same for all woodlots; in addition, the monopsonist would have to incur no administrative costs in segregating markets by distance. If the discriminating monopsonist could then reach separate "all-or-nothing" bargains, paying each individual owner the absolute minimum needed to induce harvesting and delivery, the monopsonist would secure increases in supply without additional outlay or higher prices on inframarginal supplies; the entire triangle E"S"F of excess stumpage revenues would then be captured by the monopsonist.

97. Negotiation of quantities and prices is not possible in this situation, since -- by assumption -- there are many perfectly competitive buyers; hence, the cartel will simply fix prices. To negotiate, the seller cartel must have a counterpart: a monopsonist or a buyer cartel.

98. An increase in excess supply necessarily implies a rise in per unit stumpage rates, absent price discrimination and contractor power; a decrease may be accompanied by a decrease in per unit stumpage rates.

REFERENCES

Adams, Darius M. et al. 1982. "Private investment in forest management and the long-term supply of timber," American Journal of Agricultural Economics 64(2): 232-241.

Andreason, Ove. 1978. "Future forest management trends in Sweden," The Forestry Chronicle 54(2): 29-33.

Barraclough, Solon and Ernest M. Gould. 1955. Economic analysis of farm forest operating units, Harvard Forest Bulletin 26, Petersham: Harvard University.

Baskerville, Gordon L. 1975. "Spruce budworm: the answer is forest management: or is it?" The Forest Chronicle 51(8): 157-160.

Baskerville, Gordon L. 1977. "Let's call the whole thing off!" 25-30 in Proceedings of the symposium on intensive culture of northern forest types, General Technical Report NE29. Upper Darby, Pennsylvania: USDA-FS, Northeastern Forest Experiment Station.

Baskerville, Gordon L. 1981. "Response," 55-58 in Maine, Proceedings of the Blaine House conference on forestry. Augusta: Department of Conservation.

Bassett, Charles. 1982. "Small woodlot ownership is profitable," 34-38 in Duncan Howlett, ed. The small woodland owner in Maine, Technical Notes 85. Orono: University of Maine, College of Forest Resources.

Baumol, William J. 1982. "Contestable markets: an uprising in the theory of industry structure," American Economic Review 72: 1-15.

Bell, E.F. and E.F. Thompson. 1973. "Forest management in view of death," The Forestry Chronicle 49(2): 76-78.

Belzile, Hugnes. 1982. "Improvements in the status of Quebec's private forest over the past ten years," 15-22 in Marcel Lortie and Marc Lamontagne, eds. Proceedings of the symposium on eastern Canada small private land forestry. Quebec: Laval University, Faculty of Forestry and Geodesy.

Berck, Peter. 1979. "The economics of timber: a renewable resource in the long run," The Bell Journal of Economics 10(2) 447-462.

Bickerstaff, A., W.L. Wallace and F. Evert. 1981. Growth of forests in Canada, part 2: a quantitative description of the land base and the mean annual increment, Information Report PL-X-7. Gatineau: Environment Canada, CFS.

Binkley, Clark S. 1981. Timber supply from private nonindustrial forests, Bulletin 82. New Haven: Yale University, School of Forestry and Environmental Studies.

Boulding, Kenneth E. 1966. Economic Analysis, Volume I, 4th ed. New York: Harper & Row.

Bowen, Murray G. 1978. Canada's forestry inventory - 1976, Information Report FMR-X-116. Ottawa: Environment Canada, CFS.

Butler, J.M., A.M. Case, J. Richardson and A.G. Raske. 1982. "Forest management practices in Newfoundland," 180-193 in J. Hudak and A.G. Raske, eds. Review of the spruce budworm outbreak in Newfoundland -- its control and forest management implications, Information Report N-X-205. St. John's: Environment Canada, CFS.

Carlisle, A. and A.H. Teich. 1971. The costs and benefits of tree improvement programs, Publication 1302. Ottawa: Environment Canada, CFS.

Clawson, Marion. 1977. Decision making in timber production, harvest, and marketing, Research Paper R4. Washington: Resources for the Future.

Clawson, Marion. 1979. The economics of U.S. nonindustrial private ownership, Research Paper R-14. Washington: Resources for the Future.

Clowater, W.G. and P.W. Andrews. 1981. An assessment of damage caused by the spruce budworm on spruce and balsam fir trees in New Brunswick. Fredericton: DNR-FMB.

Commission of the European Economic Communities. 1979. "Forest policy in the European Community," Bulletin of the European Communities, Supplement 3/79.

Cook, David W. 1978. "What rates of return on NIPF investments?" Journal of Forestry 76(7): 411-413.

Davis, Kenneth P. 1966. Forestry management: regulation and valuation, 2nd ed. New York: McGraw-Hill.

Duerr, William A., Henry J. Vaux and Charles H. Stoddard. 1954. "Some research needs in the economics of forestry," 161-162 in 1954 Proceedings Washington: SAF.

Duerr, William A. 1960. Fundamentals of forestry economics. New York: McGraw-Hill.

Duerr, William A. et al., eds. 1975. Forest resource management: decision-making principles and cases. Corvallis: OSU Book Stores, Inc.

Einspahr, Dean W., Gary W. Wyckoff and Marianne Fiscus. 1984. "Larch -- a fast growing fiber source for the Lake States and Northeast," Journal of Forestry 82(2): 104-106.

Ellefson, Paul V. 1974. "Timber productivity of commercial forest lands," Journal of Forestry 72(1): 2-3.

Environment Canada. 1981. "A forest sector strategy for Canada," Discussion Paper dated 30 September 1981, mimeo.

Ewing, R.A. 1981. "Public policy for private non-industrial forest ownership: the professional search for appropriate means of government intervention," Ph.D. thesis. Berkeley: University of California, microfilm.

Falk, Jonathan. 1979. Harvesting systems for silvicultural control of spruce budworm, Miscellaneous Report 221. Orono: University of Maine, Life Sciences and Agricultural Experiment Station.

Faustmann, Martin. 1849. "Berechnung des Werthes, welchen Waldboden sowie noch nicht haubare Holzbestaende fuer die Waldwirtschaft besitzen," Allgemeine Forst- und Jagdzeitung 25: 441-455.

Field, David B. 1977. "The small woodland system -- public needs vs. private goals." presented to New England Section, SAF, mimeo.

Field, David B. 1982a. "The influences of property taxation on hardwood forest management." presented to SAF National Convention, mimeo.

Field, David B. 1982b. "Impacts of fuelwood harvesting on the profitabiity of nonindustrial timber management in the northeastern U.S.," presented at the Fuelwood Management and Utilization Seminar, MSU, Michigan, mimeo.

Field, David B. 1982c. "Public policy vs. private interest," 53-63 in Duncan Howlett, ed. The small woodland owner in Maine, Technical Notes 85. Orono: University of Maine, College of Forest Resources.

Fitzsimmons, William L. and Patrice A. Harou. 1981. The economics of forestry incentives in Massachusetts: economic evaluation of FIP in 1978, Research Bulletin 669. Amherst: University of Massachusetts, College of Food and National Resources and Agricultural Experiment Station.

Foster, Bennett B. 1982. "Four horsemen of the nipf apocalypse," Journal of Forestry 80(11): 706-716.

Frank, Robert M. and John C. Bjorkbom. 1973. A silvicultural guide for spruce-fir in the northeast, General Technical Report NE6. Upper Darby, Pennsylvania: USDA-FS, Northeastern Forest Experiment Station.

Gaffney, M. Mason. 1960. Concepts of financial maturity of timber and other assets, A.E. Information Series 62. Raleigh, North Carolina: North Carolina State College, Department of Agricultural Economics.

Glascock, Hardin R. Jr. 1981. Is the family forest feasible? The S.J. Hall Lectureship in Industrial Forestry. Berkeley: University of California, School of Forestry and Conservation.

Gould, Ernest M. Jr. 1960. Fifty years of management at the Harvard Forest, Harvard Forest Bulletin 29. Petersham: Harvard University.

Goundrey, G.K. 1960. "Forest management and the theory of capital," Canadian Journal of Economics and Political Science 26(3): 439-451.

Gourou, Pierre. 1947. Les pays tropicaux. Paris: Presses Universitaires de France; in translation, 1966. The Tropical World, 4th ed. London: Longmans Green.

Gray, John L. 1978. "The nonindustrial private forest ownership problem: a viewpoint," Journal of Forestry 76(8): 466, 503.

Harou, Patrice A. 1981. "Forest ownership in the European Community," Journal of Forestry 79(5): 298, 307-309.

Hartman, Richard 1976. "The harvesting decision when a standing forest has value," Economic Inquiry 14(1): 52-58.

Heaps, Terry. 1981. "The qualitative theory of optimal rotations," The Canadian Journal of Economics 14(4): 686-699.

Hermelin, Joakim. 1982. "Is traditional technology transfer capable of creating a forest renewal on private woodlots in our changing society?" 80-85 in Marcel Lortie and Marc Lamontagne, eds. Proceedings of the symposium on eastern Canada small private land forestry. Quebec: Laval University, Faculty of Forestry and Geodesy.

Hocker, H.W. Jr. 1977. "Silvicultural potential for pre-commercial treatment of northern forest types," 135-150 in Proceedings of the symposium on intensive culture of northern forest types, General Technical Report NE29. Upper Darby, Pennsylvania: USDA-FS, Northeastern Forest Experiment Station.

Holopainen, Viljo. 1981. Outlines of Finland's forestry and forest policy. Helsinki: Helsingin Liikekirjapaino.

Howlett, Duncan, ed. 1982. The small woodland owner in Maine, Technical Notes 85. Orono: University of Maine, College of Forest Resources.

Huber, Paul B. 1983. Timber supply and factors infuencing private woodlot management in New Brunswick, A Report to the N.B. Private Woodlot Resources Study and N.B. Department of Natural Resources. Halifax: IRPP.

Hyde, William F. 1980. Timber supply, land allocation, and economic efficiency. Baltimore: Resources for the Future.

Irland, Lloyd C. 1979. "Forest management in the State of Maine," 45-67 in Brian Harvey and Mary Keith, eds. Proceedings of the Conference on forest management in New Brunswick. Fredericton: Conservation Council of New Brunswick.

Irland, Lloyd C. 1980. "Pulpwood, pesticides and people: controlling spruce budworm in northeastern North America," Environmental Management 4(5): 381-389.

Irland, Lloyd C. 1981. "Maine's timber supply," 39-54 in Maine, Proceedings of the Blaine House conference on forestry. Augusta: Department of Conservation.

Irland, Lloyd C. 1982a. "New England's foreign trade in forest products: conflicts and potentials", Tenth Annual New England Business and Economic Association Conference, mimeo.

Irland, Lloyd C. 1982b. "An update on reconstituted wood panels in New England," presented to NE Section, Forest Products Research Society, mimeo.

Irland, Lloyd C. 1982c. "Forestry and the new federalism: new forces and new options," presented at the Western Forest Insect Work Conference, mimeo.

Irland, Lloyd C. 1982d. "Federal and state assistance to non-industrial private forest owners in New England, U.S.A.: issues for the year 2000," 42-55 in Marcel Lortie and Marc Lamontagne, eds. Proceedings of the symposium on eastern Canada small private land forestry. Quebec: Laval University, Faculty of Forestry and Geodesy.

Jackson, David H. 1980. The microeconomics of the timber industry. Boulder: Westview Press.

Järvelainen, Veli-Pekka, ed. 1981. "Effectiveness of forest policy on small woodlands: contributions of working party 4.06.01. to the XVII IUFRO Congress 6-17.9." Silva Fennica 15(1): 23-111.

Johnson, K. Norman and H. Lynn Scheurman. 1977. Techniques for prescribing optimal timber harvest and investment under different objectives -- discussion and synthesis, Forest Science Management 18. Washington: Society of American Foresters.

Johnston, William F. 1978. Black spruce in north-central states, General Technical Report NC34. Grand Rapids, Minnesota: USDA-FS, North Central Forest Experiment Station.

Joseph, John, Lloyd C. Irland and Theodore E. Howard. 1979. Planning for the forest resources of Maine (Maine's forest and economic development), Evaluation document 1, 1980. Augusta: Department of Conservation, Division of Planning and Development, MFS.

Ker, M.F. 1981. Early response of balsam fir to spacing in northwestern New Brunswick, Information Report M-X-129. Fredericton, N.B.: Environment Canada, CFS, MFRC.

Kilpatrick, Dale John. 1982. "The layman's introduction to the private woodlot management situation in New Brunswick," B.Sc. Thesis. Fredericton: University of New Brunswick, unbound.

Kingsley, Neal P. 1982. "Who owns Maine's woodlots?" 22-32 in Duncan Howlett, ed. The small woodland owner in Maine, Technical Notes 85. Orono: University of Maine, College of Forest Resources.

Klemperer, David W. 1975. "The parable of the allowable pump effect," Journal of Forestry 73(10): 640-641.

Kronrad, Gary D. and Patrice A.W. Harou. 1982. An economic analysis of the forest yield tax in Massachusetts, Research Bulletin 678, Amherst: University of Massachusetts, College of Food and National Resources and Agricultural Experiment Station.

Kurtz, William B., Ralph J. Alig and Thomas J. Mills. 1980. "Retention and condition of agricultural conservation program conifer planting," Journal of Forestry 78(5): 273-296.

Kurtz, William B. and Carmen K. Crouse. 1981. Nonindustrial private forest ownership studies: a bibliography, Chicago: CPL Bibliographies.

Larson, L. Keville. 1980. "Forest productivity of private non-industrial land in Alabama," The Consultant 25(3): 62-65.

LeBlanc, Paul. 1982. "Is the freedom of choice for private woodlots in New Brunswick in jeopardy?" 6-14 in Marcel Lortie and Marc Lamontagne, eds. Proceedings of the symposium on eastern Canada small private land forestry. Quebec: Laval University, Faculty of Forestry and Geodesy.

Lees, J.C. 1978. Hardwood silviculture and management: an interpretive literature review for the Canadian Maritime Provinces, Information Report MX-93. Fredericton, N.B. : Department of Fisheries and the Environment, CFS, MFRC.

Lönnstedt, Lars. 1981. "The influence of Swedish forestry policy on the annual cuts of private woodlot owners," Silva Fennica 15(1): 100-111.

Lortie, Marcel and Marc Lamontagne, eds. 1982. Proceedings of the symposium on eastern Canada small private land forestry. Quebec City: Laval University, Faculty of Forestry and Geodesy.

Love, D.V. and J.R.M. Williams. 1968. The economics of plantation forestry in southern Ontario, The Canada Land Inventory Report 5. Richmond Hill, Ontario: Ontario Department of Lands and Forests and Department of Regional Economic Expansion.

Lowry, S. Todd and John C. Winfrey. 1974. "The kinked cost curve and the dual resource base under oligopsony in the pulp and paper industry," Land Economics 50(May): 185-192.

Lunergan, Bruce. undated. "Income tax for woodlot owners and woods contractors," Prepared for the N.B. DNR-FES. mimeo.

MacArthur, J.D. 1979. "Private forest lands in Canada: where we are and where are we going," 205-207 in SAF and CIF, North America's forests: gateway to opportunity, Proceedings 1978 Joint Convention. Washington: SAF.

MacDonald, J. Ian. 1981. "Primary forest products marketing in New Brunswick, Canada" presented to the Pulp and Paper Technical Forum, 35th annual meeting of the FPRS, St. Paul, mimeo.

MacLean, David A. 1980. "Vulnerability of fir-spruce stands during uncontrolled spruce budworm outbreaks: a review and discussion," The Forestry Chronicle 56(10): 213-221.

MacLean, David A. 1982. "Forest management," 138-140 in J. Hudak and A.G. Raske, eds. Review of the spruce budworm outbreak in Newfoundland -- its control and forest management implications, Information Report N-X-205. St. John's: Environment Canada, CFS.

MacLean, David A. and Thom A. Erdle. 1984. "A method to determine effects of spruce budworm on stand yield and wood supply projections for New Brunswick," Forestry Chronicle 60(3): 167-173.

MacQuarrie, Peter. 1981. A survey of private woodland owners in Nova Scotia, Halifax: N.S. Department of Lands and Forests.

Madigan, G. and A.R.C. Jones. 1980. "Provincial assistance to private forest owners in eastern Canada -- a survey," The Forestry Chronicle 56(6): 104-108.

Madigan, G. and A.R.C. Jones. 1981. "The private forest owners of eastern Canada - a survey," Silva Fennica 15(1): 65-72.

Manthy, Robert S. 1978. "Timber Demand," in Roger Sedjo, ed., Background papers for a workshop on policy alternatives for nonindustrial private forests, Discussion Paper 22. Washington: Resources for the Future.

McCrea, Lawrence. 1979. "Forest management on small woodlots in New Brunswick," 36-44 in Brian Harvey and Mary Keith, eds. Proceeding of the Conference on forest management in New Brunswick. Fredericton: Conservation Council of New Brunswick.

McMahon, Robert O. 1964. Private nonindustrial ownership of forest land, Bulletin 68. New Haven: Yale University, School of Forestry.

Mead, Walter J. 1966. Competition and oligopsony in the douglas fir lumber industry. Berkeley: University of California Press.

Meeks, Gordon, Jr. 1982. "State incentives for nonindustrial private forestry," Journal of Forestry 80(1): 18-22.

Miller, C.A. and I.W. Varty. 1975. "Current tactics in spruce budworm management," The Forestry Chronicle 51(8) 153-156.

Mills, Thomas J. 1976. Cost effectiveness of the 1974 Forestry Incentives Program, Research Paper RM175. Fort Collins: USDA-FS, Rocky Mountain Forest and Range Experiment Station.

Mills, Thomas J. and Daria Cain. 1978. Timber yield and financial return performance of the 1974 Forestry Incentives Program, Research Paper RM204. Fort Collins: USDA-FS, Rocky Mountain Forest and Range Experiment Station.

Mills, Thomas J. and Daria Cain. 1979. "Financial efficiency of the 1974 forestry incentives program," Journal of Forestry 77(10): 661-666.

Munro, J.A. 1982. "Economic impact of the present outbreak of the spruce budworm in Newfoundland," 80-99 in J. Hudak and A.G. Raske, eds. Review of the spruce budworm outbreak in Newfoundland -- its control and forest management implications, Information Report N-X-205. St. John's: Environment Canada, CFS.

Murphy, Daniel P. 1981. "Factors related to the adoption of woodlot practices by the Fredericton City resident woodlot owner," M.Sc.F. thesis. Fredericton: University of New Brunswick. unbound.

National Association of State Foresters and U.S. Department of Agriculture, Forest Service. 1980. Proceedings: national private non-industrial forestry conference, General Technical Report WO-22. Washington: USGPO.

National Forest Products Association. 1980. America grows on trees: the promise of private, nonindustrial woodlands, Report of the Private Woodlands Committee. Washington: NFPA.

New Brunswick. 1974. Report of the forest resources study (R.E. Tweeddale, Executive Director). Fredericton: NBFRS.

New Brunswick. 1979. "Regulation 79-150 under the forest products act." Fredericton: Queen's Printer.

New Brunswick. 1982. "Regulation 82-43 under the Crown lands and forests act." Fredericton: Queen's Printer.

New Brunswick. 1982. "Regulation 82-48 under the Crown lands and forests act." Fredericton: Queen's Printer.

New Brunswick. various dates. "Regulations under the farm products marketing act." Fredericton: Queen's Printer.

New Brunswick. various dates. "Regulations under the natural products control act." Fredericton: Queen's Printer.

New Brunswick, Cabinet Committee on Economic Development. 1976. Report of the taskforce on spruce budworm control. Fredericton: Department of Natural Resources.

New Brunswick, Crown Lands and Forests Advisory Board. 1983a. "Recommendations with respect to private woodlot wood," Majority Report. Fredericton: CLFAB, xeroxed.

New Brunswick, Crown Lands and Forests Advisory Board. 1983b. "Minority position." Fredericton: CLFAB, xeroxed.

New Brunswick, Crown Lands and Forests Advisory Board. 1983c. "Background." Fredericton: CLFAB, xeroxed.

New Brunswick, DNR-FMB. 1981. New Brunswick forest inventory. Fredericton: DNR-FMB.

New Brunswick, DNR-FUB. 1982 (and earlier years). Forest utilization survey. Fredericton: DNR-FUB.

New Brunswick, DNR. 1982a. "Forest management manual for Crown lands." Fredericton: DNR, unbound.

New Brunswick, DNR. 1982b. "Forest management agreement," mimeo.

New Brunswick, Legislature. 1978. Farm Products Marketing Act, Chapter F-6.1, as amended and consolidated. Fredericton: Queen's Printer.

New Brunswick, Legislature. 1979. Forest Products Act, Chapter F-21, consolidated to 1979. Fredericton: Queen's Printer.

New Brunswick, Legislature. 1980. Crown Lands and Forests Act, Chapter C-38.1, as amended and consolidated. Fredericton: Queen's Printer.

New Brunswick, Legislature. 1981. "Report of the select committee on renewable resources to the third session, 49th Legislature," mimeo.

New Brunswick, Minister of Natural Resources. 1983. "Statement," dated June 3, 1983 before the Legislature, mimeo.

New Brunswick, Private Woodlot Resources Study. 1983. Private woodlots: what does the future hold? Report. Fredericton: NBPWRS.

New Brunswick, Task Force on Forest Management. 1981. Final report to the Minister of Natural Resources. Fredericton: DNR-FMB.

New Brunswick Federation of Woodlot Owners. 1982a. 1982-83 Report. Fredericton: NBFWO.

New Brunswick Federation of Woodlot Owners. 1982b. Negotiations Material for 1983-84 Contract Negotiations. Fredericton: NBFWO.

Norway, Det Kongelige Landbruksdepartement. 1982. "Country report on public management of programmes and policies for private forestry," mimeo.

Nova Scotia, Forest Practices Improvement Board, ed. 1980. The trees around us, a manual of good forest practices for Nova Scotia, Halifax: Crown Copyright.

Nova Scotia, Royal Commission on Forestry. 1984. Forestry, Report of the Nova Scotia Royal Commission. Halifax: Queen's Printer.

O'Neill, H.J. 1979, "Critical concerns of people in the New Brunswick forest industry," 21-26 in Brian Harvey and Mary Keith, eds. Proceedings of the Conference on forest management in New Brunswick. Fredericton: Conservation Council of New Brunswick.

Oedekoven, Karl. 1981. "Small private forests in the Federal Republic of Germany," Journal of Forestry 79(3): 161-162.

Ontario, Ministry of Natural Resources. 1982. Private land forests: a public resource. Toronto: MNR.

Page, Talbot. 1977. Conservation and economic efficiency: an approach to materials policy. Baltimore: Johns Hopkins University Press.

Palosuo, V.J. 1982. "Experiences on enhancing small private private-land resources in Finnish forestry," 66-77 in Marcel Lortie and Marc Lamontagne, eds. Proceedings of the symposium on eastern Canada small private land forestry. Quebec: Laval University, Faculty of Forestry and Geodesy.

Pearse, P.H. 1967. "The optimum forest rotation," The Forestry Chronicle 43(9): 178-195.

Peat Marwick and Partners. 1977. Analysis of wood costs in the North American forest product industries. Ottawa: Department of Industry, Trade and Commerce.

Phlips, Louis. 1983. The economics of price discrimination. Cambridge: Cambridge University Press.

Place, I.C.M. 1978. "Forestry in Canada", Journal of Forestry, 76(6): 557-562.

Plochmann, R. 1974. "Trends and aspects of forest legislation in Germany," Journal of Forestry 72(4): 202-207.

Popovich, Luke. 1978. "Working with the woodland owner: close encounters with a third kind," Journal of Forestry 76(4): 228-30.

Pøyry, Jaakko & Associates, Ltd. 1978. Analysis of manufacturing costs in some Scandinavian pulp and paper industries. Ottawa: Department of Industry, Trade and Commerce.

Puttock, G.D. 1982. "A summary of taxation measures affecting forest management on private lands in Ontario," The Forestry Chronicle 58(4): 1982.

Randers, Jørgen and John E. Høsteland. 1979. "The response to mounting pressure on the Scandinavian forest sector," The Forestry Chronicle 55(12): 229-236.

Raup, Philip M. 1978. Reflections on the public interest in private nonindustrial forest lands, Miscellaneous Journal Series Paper 1690. Minnesota: Agricultural Experiment Station.

Reed, F.L.C. & Associates, Ltd. 1978. Forest Management in Canada, Information Report FMR-X-102, 2 vols. Ottawa: Environment Canada, CFS, FMI.

Risbrudt, Christopher D. and Paul V. Ellefson. 1982. An economic evaluation of the 1979 forestry incentives program. St. Paul: USDA-FS & University of Minnesota, College of Forestry and Agricultural Experiment Station.

Rose, A.H. and O.H. Lindquist. 1977. Insects of Eastern Spruce, Fir and Hemlock, Forestry Technical Report 23. Ottawa: Environment Canada, CFS.

Routledge, R.D. 1980. "The effect of potential catastrophic mortality and other unpredictable events on optimal forest rotation policy," Forest Science 26(3): 389-399.

Row, Clark. 1978. "Economics of tract size in timber growing," Journal of Forestry 76(9): 576-582.

Row, Clark, H. Fred Kaiser and John Sessions. 1981. "Discount rate for long-term forest service investments," Journal of Forestry, 79(6): 367-376.

Roy, Pauline 1983. New Brunswick nonindustrial private woodlot owner survey, A background paper for the N.B. Private Woodlot Resources Study. Fredericton, NBPWRS.

Royer, Jack P. and Frank J. Convery, eds. 1980. Proceedings of the conference on nonindustrial private forestry: data and information needs. Durham, N.C.: Duke University, Center for Resource and Environmental Policy Research.

Runyon, Kenneth L. 1983. Fair market prices for pulpwood in New Brunswick, Information Report M-X-144. Fredericton: Environment Canada, CFS, MFRC.

Saastamoinen, Olli. 1982. "Economics of multiple-use forestry in the Saariselka forest and fell area," Communicationes Instituti Forestalis Fenniae, 104.

Samuelson, Paul A. 1976. "Economics of forestry in an evolving society" Economic Inquiry 14(4): 466-492.

Schweitzer, Dennis L., Robert W. Sassaman and Con H. Schallau. 1972. "Allowable cut effects," Journal of Forestry 70(7) 415-418.

Sedjo, Roger A. 1979. "Policy alternatives: an overview report from the workshop on nonindustrial private forests." 211-214 in SAF and CIF, North America's Forests: Gateway to Opportunity, Proceedings of the 1978 Convention. Washington: SAF.

Sedjo, Roger A. 1982. The forest in transition: intensive forest management options in the Pacific northwest in comparison with opportunities in other regions and countries, The H.R. MacMillan Lectureship in Forestry. Vancouver: University of British Columbia.

Sedjo, Roger A. 1983. The comparative economics of plantation forestry: a global assessment. Washington: Resources for the Future.

Sedjo, Roger A. and David M. Ostermeier. 1978. Policy alternatives for nonindustrial private forests, Report of the workshop on policy alternatives for nonindustrial private forests. Washington: Society of American Foresters and Resources for the Future.

Sizemore, William R. 1973. "Improving the productivity of nonindustrial private woodlands," Appendix I, 234-295 in President's Advisory Panel on Timber and the Environment, Report. Washington: U.S. Government Printing Office.

Skog, Kenneth, and Christopher Risbrudt. 1982. "Trends in economic scarcity of U.S. timber commodities," USDA-FS, Resource Bulletin FPL11.

Skok, Richard A. and Hans M. Gregersen. 1975. "Motivating private forestry: an overview," Journal of Forestry 73(4): 202-05.

Slocum, Bob and Charles M. Tarver. 1982. "Tax and the tree farmer: protecting an estate," The American Tree Farmer, (May/June): 22.

Smith, J. Harry G. 1976. "Investment implications of sustained yield theories and criteria for improving forest land management," 142-170 in William McKillop and Walter J. Mead, eds. Timber policy issues in British Columbia. Vancouver: University of British Columbia Press.

Smyth, J.H. and I.A. Nausedas. 1982. Rural lands and landowners of Ontario: private land forestry perspective. Toronto: MNR and Environment Canada, CFS, GLFRC.

Society of American Foresters. 1979. Improving outputs from non-industrial forests: a task force study report. Washington: SAF.

Statistics Canada. 1982 (11-003). Canadian Statistical Review. December, 1982.

Statistics Canada. 1982 (13-210). Income after tax: distribution by size in Canada, 1979. Ottawa: Supply and Services.

Statistics Canada. 1982 (13-213). Provincial economic accounts: experimental data 1965-1980. Ottawa: Supply & Services.

Statistics Canada. 1982 (25-202). Canadian forestry statistics 1980. Ottawa: Supply & Services.

Stiell, W.M. and A.B. Berry. 1973a. Development of unthinned white spruce plantations to age 50 at Petawawa forest experiment station, CFS Publication 1317. Ottawa: Environment Canada.

Stiell, W.M. and A.B. Berry. 1973b. Yield of unthinned red pine plantations at the Petawawa forest experiment station, CFS Publication 1320. Ottawa: Environment Canada.

Stjernquist, Per. 1973. Laws in the forests: a study of public direction of Swedish private forestry. Lund: CWK Gleerup.

Stoddard, Charles H. 1961. The small private forest in the United States. Washington: Resources for the Future.

Stoddard, Charles H. 1978. "Proposed management and marketing foundation for improving production on small forests," Journal of Forestry 76(3): 153-159.

Teeguarden, Dennis E. 1973. "The allowable cut effect: a comment," Journal of Forestry, 73(10) 640-642.

Thompson, Emmett F. 1966. "Traditional forest regulation model: an economic critique", Journal of Forestry, 64(12): 750-752.

Tothill, J.D. 1921. "An estimate of the damage done in New Brunswick by the spruce budworm," Acadian Entomological Society Proceedings 7: 45-49.

Trokey, Carol B. and William B. Kurtz. 1982. "Increasing timber management through a better understanding of nonindustrial private forest owner's (sic!) motivations and objectives," The Consultant 27(3): 57-59.

United Nations, FAO/ECE/EPC. 1979. Effect of taxation on forest management and roundwood supply in Europe. Geneva: FAO.

U.S. Department of Agriculture, Forest Service. 1933. National Plan for American Forestry, Washington: USGPO.

U.S. Department of Agriculture, Forest Service. 1946. The management status of forest lands in the United States, FRR 3. Washington: USGPO.

U.S. Department of Agriculture, Forest Service. 1958. Timber resources for America's future, FRR 14. Washington: USGPO.

U.S. Department of Agriculture, Forest Service. 1965. Timber trends in the United States, FRR 17. Washington: USGPO.

U.S. Department of Agriculture, Forest Service. 1973. The outlook for timber in the United States, FRR 20. Washington: USGPO.

U.S. Department of Agriculture, Forest Service. 1976. Final environmental impact statement and renewable resource program, 1977-2020, FRR 22. Washington: USGPO.

U.S. Department of Agriculture. 1978. The federal role in the conservation and management of private nonindustrial forest lands, an interagency committee report. Washington: USDA.

Vardaman, James M. 1978. "Attitudes of foresters toward the small private landowner," Journal of Forestry 76(6): 369, 368.

Watson, Robert S. 1983. New Brunswick forest industry & forest resources: an overview, A background paper for the N.B. Private Woodlot Resources Study. Fredericton: NBPWRS.

Weetman, Gordon F. 1977. "Present extent and technology available for intensive management and extent of present use," 31-42 in Proceedings of the symposium on intensive culture of northern forest types, General Technical Report NE29. Upper Darby, Pennsylvania: USDA-FS, Northeastern Forest Experiment Station.

Welton, E.A.F. et al. 1978. "Tax incentives for investment in intensive forestry," The Forestry Chronicle 54(6): 167-170.

Woodlot Service. 1982a. "Review of Market Stumpage Values: March - 1982," xeroxed.

Woodlot Service. 1982b. "Review of Market Stumpage Values: December - 1982," xeroxed.

Worrell, Albert C. and Lloyd C. Irland. 1975. "Alternative means of motivating investment in private forestry," Journal of Forestry 73(4): 206-209.

Zivnuska, John A. 1959. Private forestry in Norway - a case study in small woodland management and policy, Forest Science Monograph 1. Washington: Society of American Foresters.

Zivnuska, John A. 1978. "Two studies of private nonindustrial forest lands," Journal of Forestry 76(8) 467-469.

THE MEMBERS OF THE INSTITUTE

Board of Directors

The Honourable John B. Aird, O.C., Q.C.
(Honorary Chairman)
Lieutenant Governor of Ontario, Toronto

The Honourable Robert L. Stanfield, P.C., Q.C.
(Chairman), Ottawa

Claudine Sotiau (Vice-Chairman)
Ducros, Meilleur, Roy et Associés Ltée
Montréal

Louis A. Desrochers, Q.C.
McCuaig, Desrochers, Edmonton

Claude Castonguay, C.C.
Président et chef de la direction
La Corporation du Groupe
La Laurentienne, Québec

Roger Charbonneau
Président du conseil d'administration
Banque Nationale de Paris (Canada)
Montréal

Dr. Rod Dobell
President, The Institute for Research on Public Policy, Victoria

Dr. Henry E. Duckworth, O.C.
President Emeritus
University of Winnipeg

Dr. Regis Duffy
President, Diagnostic Chemicals Ltd.
Charlottetown

Dr. James D. Fleck
Faculty of Management Studies
University of Toronto

Peter C. Godsoe
Vice Chairman of the Board, The Bank of Nova Scotia, Toronto

Dianne I. Hall
Senior Vice-President, NOVA, AN ALBERTA CORPORATION, Calgary

The Honourable William M. Hamilton, P.C., O.C., LL.D. Royal Commission on the Economic Union and Development Prospects for Canada, Vancouver

Grace Hartman
President Emeritus, CUPE, Willowdale

David Hennigar
Atlantic Regional Director
Burns Fry Limited, Halifax

T.E. Kierans
President, McLeod Young Weir Limited
Toronto

Roland J. Lutes, C.A.
Clarkson Gordon, Saint John

Dr. Patrick O'Flaherty
Head, Department of English Language and Literature, Memorial University of Newfoundland
St. John's

Dr. Tom Pepper
Pepper Consultants Ltd., Saskatoon

Guy Roberge, C.R., Conseil
Clarkson, Tétrault, Ottawa

Thérèse P. Sévigny
Vice-présidente à la communication
Société Radio-Canada, Ottawa

Secretary

Peter C. Dobell
Director, Parliamentary Centre
for Foreign Affairs and Foreign Trade
Ottawa

Treasurer

Parker Staples
Director, Financial Services, The Institute for Research on Public Policy, Halifax

Executive Committee

The Honourable Robert L. Stanfield
(Chairman)
Claudine Sotiau (Vice-Chairman)
Peter C. Dobell
Rod Dobell
Tom Kierans
Roland J. Lutes

Investment Committee

Tom Kierans (Chairman)
Marcel Cazavan
Peter C. Dobell
Peter C. Godsoe
Michael Koerner

Council of Trustees

Members at Large

Dr. Stefan Dupré (Chairman)
Department of Political Science
University of Toronto
Doris H. Anderson, O.C.
Toronto
Professor Kell Antoft
Institute of Public Affairs
Dalhousie University, Halifax
Marie-Andrée Bertrand
École de criminologie
Université de Montréal
Dr. Roger A. Blais
École Polytechnique de Montréal
George Cooper, Q.C.
McInnes, Cooper and Robertson, Halifax
James S. Cowan, Q.C.
Partner
Stewart, MacKeen & Covert, Halifax
V. Edward Daughney
President, First City Trust Company
Vancouver
Dr. Wendy Dobson
Executive Director, C.D. Howe Institute
Toronto
Marc Eliesen
Chairperson
Manitoba Energy Authority, Winnipeg
Emery Fanjoy
Secretary, Council of Maritime Premiers
Halifax
Dr. Allan K. Gillmore
Executive Director, Association of
Universities and Colleges of Canada
Ottawa
Dr. Donald Glendenning
President, Holland College, Charlottetown
Margaret C. Harris
Past President, The National Council of
Women of Canada, Saskatoon
Richard W. Johnston
President, Spencer Stuart & Associates
Toronto
Dr. Leon Katz, O.C.
Saskatoon
R. Terrence Mactaggart
President, The Niagara Institute
Niagara-on-the-Lake
Dr. John S. McCallum
Faculty of Administrative Studies
University of Manitoba, Winnipeg
Claude Morin
École nationale d'administration publique
Québec
Milan Nastich
President, Ontario Hydro, Toronto
Professor William A. W. Neilson
Dean, Faculty of Law, University of Victoria
Roderick C. Nolan, P.Eng.
Executive Vice-President, Neill &
Gunter Limited, Fredericton
Robert J. Olivero
United Nations Secretariat, New York
Maureen O'Neil
Co-ordinator, Status of Women Canada
Ottawa
Garnet T. Page, O.C.
Calgary
Dr. Gilles Paquet
Dean, Faculty of Administration
University of Ottawa
Dr. K. George Pedersen
President, University of Western Ontario
London
Professor Marilyn L. Pilkington
Osgoode Hall Law School, Toronto
Dr. David W. Slater
Chairman, Economic Council of Canada
Ottawa
Dr. Stuart L. Smith
Chairman, Science Council of Canada
Ottawa
Eldon D. Thompson
President, Telesat, Vanier
Marc-Adélard Tremblay, O.C.
Département d'anthropologie
Université Laval, Québec
Dr. Israel Unger
Department of Chemistry, University of
New Brunswick, Fredericton
Philip Vineberg, O.C., Q.C.
Phillips & Vineberg, Montreal
Dr. Norman Wagner
President, University of Calgary
Ida Wasacase, C.M.
Federation of Saskatchewan
Indian Nations, Ottawa
Dr. R. Sherman Weaver
Director, Alberta Environmental Centre
Vegreville
Dr. Blossom Wigdor
Director, Program in Gerontology
University of Toronto

Government Representatives

Joseph H. Clarke, Nova Scotia
Michael Decter, Manitoba
Jim Dinning, Alberta
Rob McWilliam, Yukon
Honourable Lowell Murray, Canada
John H. Parker, Northwest Territories
Henry Phillips, Prince Edward Island
Norman Riddell, Saskatchewan
Jean-K. Samson, Québec
Gordon S. Smith, Canada
Norman Spector, British Columbia
Barry Toole, New Brunswick
John Tory, Ontario
Herb Clarke, Newfoundland

INSTITUTE MANAGEMENT

Rod Dobell	President
Louis Vagianos	Special Assistant
Jean-Luc Pepin	Fellow-in-Residence
Gordon Robertson	Fellow-in-Residence
John M. Curtis	Director, International Economics Program
Yvon Gasse	Director, Small and Medium-Sized Business Program
Barbara L. Hodgins	Director, Western Resources Program
Barry Lesser	Director, Regional Employment Opportunities Program
Shirley Seward	Director, Co-ordination and Liaison
Parker Staples	Director, Financial Services & Treasurer
Donald Wilson	Director, Communications
Tom Kent	Editor, *Policy Options Politiques*

PUBLICATIONS AVAILABLE*

JUNE 1985

Leroy O. Stone & Claude Marceau	*Canadian Population Trends and Public Policy Through the 1980s.* 1977 $4.00
Raymond Breton	*The Canadian Condition: A Guide to Research in Public Policy.* 1977 $2.95
Raymond Breton	*Une orientation de la recherche politique dans le contexte canadien.* 1977 $2.95
J.W. Rowley & W.T. Stanbury (eds.)	*Competition Policy in Canada: Stage II, Bill C-13.* 1978 $12.95
W.E. Cundiff	*Nodule Shock? Seabed Mining and the Future of the Canadian Nickel Industry.* 1978 $3.00
C.F. Smart & W.T. Stanbury (eds.)	*Studies on Crisis Management.* 1978 $9.95
W.T. Stanbury (ed.)	*Studies on Regulation in Canada.* 1978 $9.95
Michael Hudson	*Canada in the New Monetary Order: Borrow? Devalue? Restructure!* 1978 $6.95
Robert A. Russel	*The Electronic Briefcase: The Office of the Future.* 1978 $3.00

***Order Address:** The Institute for Research on Public Policy
P.O. Box 3670
Halifax, Nova Scotia
B3J 3K6

C.C. Gotlieb	*Computers in the Home: What They Can Do for Us—And to Us.* 1978 $3.00
David K. Foot (ed.)	*Public Employment and Compensation in Canada: Myths and Realities.* 1978 $10.95
Raymond Breton & Gail Grant Akian	*Urban Institutions and People of Indian Ancestry: Suggestions for Research.* 1979 $3.00
K.A.J. Hay	*Friends or Acquaintances? Canada and Japan's Other Trading Partners in the Early 1980s.* 1979 $3.00
Thomas H. Atkinson	*Trends in Life Satisfaction Among Canadians, 1968-1977.* 1979 $3.00
W.E. Cundiff & Mado Reid (eds.)	*Issues in Canadian U.S. Transborder Computer Data Flows.* 1979 $6.50
Meyer W. Bucovetsky (ed.)	*Studies in Public Employment and Compensation in Canada.* 1979 $14.95
Richard French & André Béliveau	*The RCMP and the Management of National Security.* 1979 $6.95
Richard French & André Béliveau	*La GRC et la gestion de la sécurité nationale.* 1979 $6.95
Fred Thompson & W.T. Stanbury	*The Political Economy of Interest Groups in the Legislative Process in Canada.* 1979 $3.00
G. Bruce Doern & Allan M. Maslove (eds.)	*The Public Evaluation of Government Spending.* 1979 $10.95
Leroy O. Stone & Michael J. MacLean	*Future Income Prospects for Canada's Senior Citizens.* 1979 $7.95
Richard M. Bird	*The Growth of Public Employment in Canada.* 1979 $12.95
Richard J. Schultz	*Federalism and the Regulatory Process.* 1979 $1.50
Richard J. Schultz	*Le fédéralisme et le processus de réglementation.* 1979 $1.50
Lionel D. Feldman & Katherine A. Graham	*Bargaining for Cities, Municipalities and Intergovernmental Relations: An Assessment.* 1979 $10.95
Elliot J. Feldman & Neil Nevitte (eds.)	*The Future of North America: Canada, the United States, and Quebec Nationalism.* 1979 $7.95

Pierre Sormany	*Les micro-esclaves : vers une bio-industrie canadienne*. 1979 $3.00
David R. Protheroe	*Imports and Politics: Trade Decision Making in Canada, 1968-1979*. 1980 $8.95
Zavis P. Zeman & David Hoffman (eds.)	*The Dynamics of the Technological Leadership of the World*. 1980 $3.00
G. Bruce Doern	*Government Intervention in the Canadian Nuclear Industry*. 1980 $8.95
G. Bruce Doern & Robert W. Morrison (eds.)	*Canadian Nuclear Policies*. 1980 $14.95
Russell Wilkins	*Health Status in Canada, 1926-1976*. 1980 $3.00
Russell Wilkins	*L'état de santé au Canada, 1926-1976*. 1980 $3.00
Allan M. Maslove & Gene Swimmer	*Wage Controls in Canada: 1975-78: A Study of Public Decision Making*. 1980 $11.95
T. Gregory Kane	*Consumers and the Regulators: Intervention in the Federal Regulatory Process*. 1980 $10.95
Réjean Lachapelle & Jacques Henripin	*La situation démolinguistique au Canada: évolution passée et prospective*. 1980 $24.95
Albert Breton & Anthony Scott	*The Design of Federations*. 1980 $6.95
A.R. Bailey & D.G. Hull	*The Way Out: A More Revenue-Dependent Public Sector and How It Might Revitalize the Process of Governing*. 1980 $6.95
David R. Harvey	*Christmas Turkey or Prairie Vulture? An Economic Analysis of the Crow's Nest Pass Grain Rates*. 1980 $10.95
Donald G. Cartwright	*Official Language Populations in Canada: Patterns and Contacts*. 1980 $4.95
Richard M. Bird	*Taxing Corporations*. 1980 $6.95
Leroy O. Stone & Susan Fletcher	*A Profile of Canada's Older Population*. 1980 $7.95
Peter N. Nemetz (ed.)	*Resource Policy: International Perspectives*. 1980 $18.95

Keith A.J. Hay (ed.)	*Canadian Perspectives on Economic Relations With Japan.* 1980 $18.95
Dhiru Patel	*Dealing With Interracial Conflict: Policy Alternatives.* 1980 $5.95
Raymond Breton & Gail Grant	*La langue de travail au Québec : synthèse de la recherche sur la rencontre de deux langues.* 1981 $10.95
Diane Vanasse	*L'évolution de la population scolaire du Québec.* 1981 $12.95
David M. Cameron (ed.)	*Regionalism and Supranationalism: Challenges and Alternatives to the Nation-State in Canada and Europe.* 1981 $9.95
Heather Menzies	*Women and the Chip: Case Studies of the Effects of Information on Employment in Canada.* 1981 $8.95
H.V. Kroeker (ed.)	*Sovereign People or Sovereign Governments.* 1981 $12.95
Peter Aucoin (ed.)	*The Politics and Management of Restraint in Government.* 1981 $17.95
Nicole S. Morgan	*Nowhere to Go? Possible Consequences of the Demographic Imbalance in Decision-Making Groups of the Federal Public Service.* 1981 $8.95
Nicole S. Morgan	*Où aller? Les conséquences prévisibles des déséquilibres démographiques chez les groupes de décision de la fonction publique fédérale.* 1981 $8.95
Raymond Breton, Jeffrey G. Reitz & Victor F. Valentine	*Les frontières culturelles et la cohésion du Canada.* 1981 $18.95
Peter N. Nemetz (ed.)	*Energy Crisis: Policy Response.* 1981 $10.95
James Gillies	*Where Business Fails.* 1981 $9.95
Robert A. Russel	*Office Automation: Key to the Information Society.* 1981 $3.00
Allan Tupper & G. Bruce Doern (eds.)	*Public Corporations and Public Policy in Canada.* 1981 $16.95
Réjean Lachapelle & Jacques Henripin	*The Demolinguistic Situation in Canada: Past Trends and Future Prospects.* 1982 $24.95

Irving Brecher	*Canada's Competition Policy Revisited: Some New Thoughts on an Old Story.* 1982 $3.00
Ian McAllister	*Regional Development and the European Community: A Canadian Perspective.* 1982 $13.95
Donald J. Daly	*Canada in an Uncertain World Economic Environment.* 1982 $3.00
W.T. Stanbury & Fred Thompson	*Regulatory Reform in Canada.* 1982 $7.95
Robert J. Buchan, C. Christopher Johnston, T. Gregory Kane, Barry Lesser, Richard J. Schultz & W.T. Stanbury	*Telecommunications Regulation and the Constitution.* 1982 $18.95
Rodney de C. Grey	*United States Trade Policy Legislation: A Canadian View.* 1982 $7.95
John Quinn & Philip Slayton (eds.)	*Non-Tariff Barriers After the Tokyo Round.* 1982 $17.95
Stanley M. Beck & Ivan Bernier (eds.)	*Canada and the New Constitution: The Unfinished Agenda.* 2 vols. 1982 $10.95
R. Brian Woodrow & Kenneth B. Woodside (eds.)	*The Introduction of Pay-TV in Canada: Issues and Implications.* 1982 $14.95
E.P. Weeks & L. Mazany	*The Future of the Atlantic Fisheries.* 1983 $5.00
Douglas D. Purvis (ed.), assisted by Frances Chambers	*The Canadian Balance of Payments: Perspectives and Policy Issues.* 1983 $24.95
Roy A. Matthews	*Canada and the "Little Dragons": An Analysis of Economic Developments in Hong Kong, Taiwan, South Korea and the Challenge Opportunity They Present for Canadian Interests in the 1980s.* 1983 $11.95
Charles F. Doran	*Economic Interdependence, Autonomy, and Canadian-American Relations.* 1983 $5.00
Charles Pearson & Gerry Salembier	*Trade, Employment, and Adjustment.* 1983 $5.00
Steven Globerman	*Cultural Regulation in Canada.* 1983 $11.95
F.R. Flatters & R.G. Lipsey	*Common Ground for the Canadian Common Market.* 1983 $5.00

Frank Bunn, assisted by U. Domb, D. Huntley, H. Mills, H. Silverstein	*Oceans from Space: Towards the Management of Our Coastal Zones.* 1983 $5.00
C.D. Shearing & P.C. Stenning	*Private Security and Private Justice: The Challenge of the 80s.* 1983 $5.00
Jacob Finkelman & Shirley B. Goldenberg	*Collective Bargaining in the Public Service: The Federal Experience in Canada.* 2 vols. 1983 $29.95
Gail Grant	*The Concrete Reserve: Corporate Programs for Indians in the Urban Work Place.* 1983 $5.00
Owen Adams & Russell Wilkins	*Healthfulness of Life.* 1984 $8.00
Yoshi Tsurumi with Rebecca R. Tsurumi	*Sogoshosha: Engines of Export-Based Growth* (Revised Edition). 1984 $10.95
Raymond Breton & Gail Grant	*The Dynamics of Government Programs for Urban Indians in the Prairie Provinces.* 1984 $19.95
Frank Stone	*Canada, The GATT and the International Trade System.* 1984 $15.00
Pierre Sauvé	*Private Bank Lending and Developing-Country Debt.* 1984 $10.00
Mark Thompson & Gene Swimmer (eds.)	*Conflict or Compromise: The Future of Public Sector Industrial Relations.* 1984 $15.00
Samuel Wex	*Instead of FIRA: Autonomy for Canadian Subsidiaries.* 1984 $8.00
R.J. Wonnacott	*Selected New Developments in International Trade Theory.* 1984 $7.00
R.J. Wonnacott	*Aggressive US Reciprocity Evaluated with a New Analytical Approach to Trade Conflicts.* 1984 $8.00
Richard W. Wright	*Japanese Business in Canada: The Elusive Alliance.* 1984 $12.00
Paul K. Gorecki & W.T. Stanbury	*The Objectives of Canadian Competition Policy, 1888-1983.* 1984 $15.00
Michael Hart	*Some Thoughts on Canada-United States Sectoral Free Trade.* 1985 $7.00

J. Peter Meekison Roy J. Romanow & William D. Moull	*Origins and Meaning of Section 92A: The 1982 Constitutional Amendment on Resources.* 1985 $10.00
Conference Papers	*Canada and International Trade. Volume One: Major Issues of Canadian Trade Policy. Volume Two: Canada and the Pacific Rim.* 1985 $25.00 (set)
A.E. Safarian	*Foreign Direct Investment: A Survey of Canadian Research.* 1985 $8.00
Joseph R. D'Cruz & James D. Fleck	*Canada Can Compete! Strategic Management of the Canadian Industrial Portfolio.* 1985 $18.00
Barry Lesser & Louis Vagianos	*Computer Communications and the Mass Market in Canada.* 1985 $10.00
W.R. Hines	*Trade Policy Making in Canada: Are We Doing it Right?* 1985 $10.00
Bertrand Nadeau	*Britain's Entry into the European Economic Community and its Effect on Canada's Agricultural Exports.* 1985 $10.00
Paul B. Huber	*Promoting Timber Cropping: Policies Toward Non-Industrial Forest Owners in New Brunswick.* 1985 $10.00

The Institute for Research on Public Policy
L'Institut de recherches politiques

A national, independent, research organization
Un organisme de recherche national et indépendant

Créé en 1972, l'Institut de recherches politiques est un organisme national dont l'indépendance et l'autonomie sont assurés grâce à des revenus provenant d'un fonds de dotation auquel souscrivent les gouvernements fédéral et provinciaux ainsi que le secteur privé. L'Institut obtient en outre des subventions et des contrats des gouvernements, des compagnies et des fondations afin de réaliser certains projets de recherche.

La raison d'être de l'Institut est triple :

- Servir de catalyseur au sein de la collectivité nationale en favorisant un débat public éclairé sur les principales questions d'intérêt général.
- Stimuler la participation de tous les éléments de la collectivité nationale à l'élaboration de la politique d'État.
- Trouver des solutions réalisables aux importants problèmes d'ordre politique afin de contribuer à l'élaboration d'une saine politique d'État.

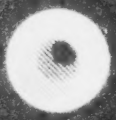
Un Conseil d'administration, chargé de la décision, et une Commission de direction, responsable d'éclairer le Conseil sur l'orientation de la recherche, assurent la direction de l'Institut. L'administration courante des politiques, des programmes et du personnel relève du président.

L'Institut fonctionne de manière décentralisée et retient les services de chercheurs en divers points du Canada, s'assurant ainsi que toutes les régions contribuent aux recherches.

L'Institut cherche à favoriser, dans la mesure du possible, la compréhension et la discussion publiques des questions d'envergure nationale, controversées ou non. Il publie les conclusions de ses recherches avec clarté et impartialité. Les recommandations ou les conclusions énoncées dans les publications de l'Institut sont strictement celles de l'auteur et n'engagent aucunement le conseil d'administration, la commission de direction ou les bailleurs de fonds.

Le président assume la responsabilité ultime de publier un manuscrit au nom de l'Institut. Il jouit à cette fin des conseils du personnel de l'Institut et de critiques de l'extérieur quant à l'exactitude et l'objectivité du texte. Ne sont publiés que les textes qui traitent de façon compétente d'un sujet digne de la réflexion du public.

Les publications de l'Institut paraissent dans la langue de l'auteur et sont accompagnées d'un abrégé dans les langues officielles du Canada.



The Institute for Research on Public Policy
L'Institut de recherches politiques

A national, independent, research organization
Un organisme de recherche national et indépendant